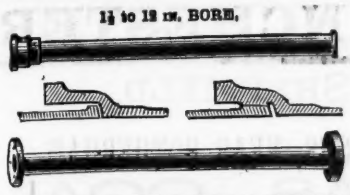
THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXIV. No. 1626.] LONDON, JULY 10, 1894. [46TH YEAR. PRICE 6d.

GAS AND WATER PIPES

1¼ to 12 IN. BORE.



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Bon Lea Foundry,

SOUTH STOCKTON-ON-TEES.

ALSO MANUFACTURERS OF
SANITARY & RAIN-WATER PIPES, HOT WATER PIPES, STABLE FITTINGS, RANGES, STOVES, And GENERAL CASTINGS.

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(REGISTERED)
THE CHEAPEST AND MOST ECONOMICAL SOLID LUBRICANT EXTANT.

Specially adapted and supplied to Gas Companies for lubricating Charging and Drawing Machines.

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Write for Samples.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

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NEWCASTLE-ON-TYNE.
W. RICHARDSON, Fitter.

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PARKER & LESTER,
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THE ONLY MAKERS OF
PATENT ANTIMONY PAINT,
Parker's Imperial Black Varnish,
Oxide Paints, Oils, and General Stores for Gas and Water Works.

WORKS:
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WOLSTON'S
TORBAY PAINTS
Special Quotations to Gas Companies.
DARTMOUTH, DEVON.

THE "C" BURNER.
NEW HIGH-POWER GAS-LIGHT.
INCANDESCENT GAS-LIGHT SYSTEM.

Consumes 3¾ cubic feet per hour.

Gives a light of 70 to 80 candle power.

Brilliant Light.

Perfectly Steady and Noiseless.

Smokeless.

Reduced Heat.

The Ordinary Burner, with Special Globes, is suitable for Lighting Private Houses, Public Houses, Restaurants, Shops, &c.

Special Lamps constructed for Outside Lighting and Street Lighting; and Large Clusters of Lights made for Lighting Halls and large Areas from one centre.

Can be attached to any Gas-Fittings.

THE TRIUMPH OF GAS OVER ELECTRIC LIGHT.

Taking Gas at 3s. per 1000 cubic feet and Electric Light at 8d. per Board of Trade unit, the "C" Burner will produce an equal amount of light at **One-eighth the cost of Electric Light.** This cannot be disproved.

Substantial and Pushing Sole Agents wanted in each Town using Gas.

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CASH PREPAYMENT METERS.

THE "POSITIVE" PREPAYMENT-SLOT-METER.

Noted for Strength and Simplicity of Construction.

Used by many Corporations and Gas Companies.

Material and Workmanship of the best.

Prices and full Particulars on application.

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ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.

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Analysis: 12,600 feet of 19-candle gas per ton.
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Retort Setters sent to any part of the Kingdom.

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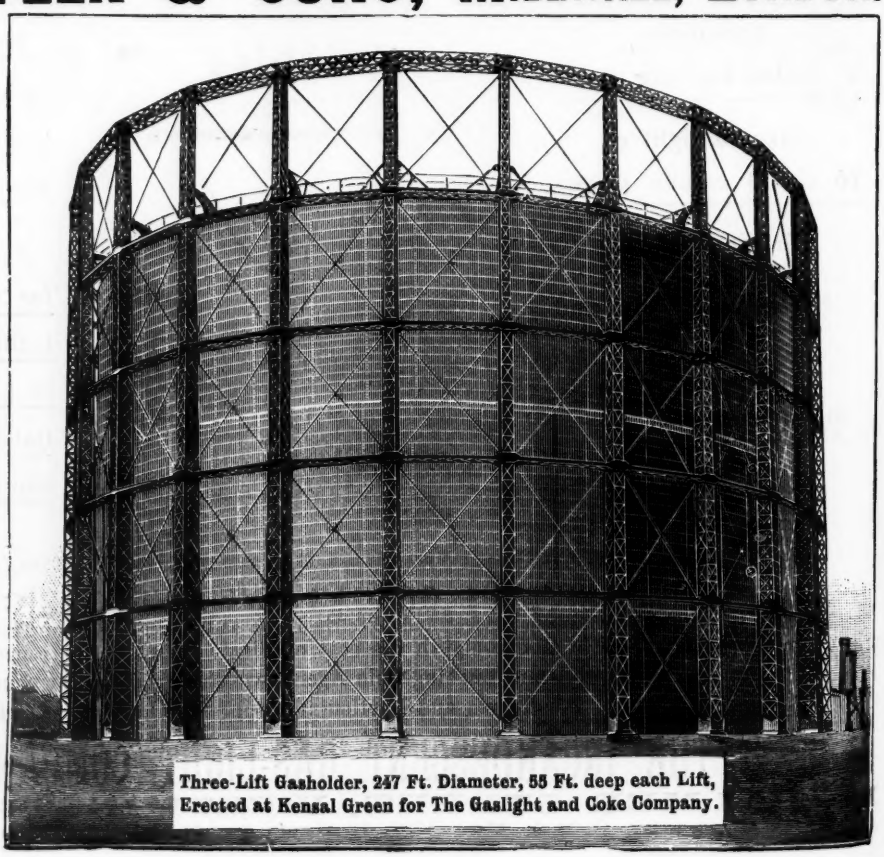

Three-Lift Gasholder, 247 Ft. Diameter, 55 Ft. deep each Lift,
Erected at Kensal Green for The Gaslight and Coke Company.

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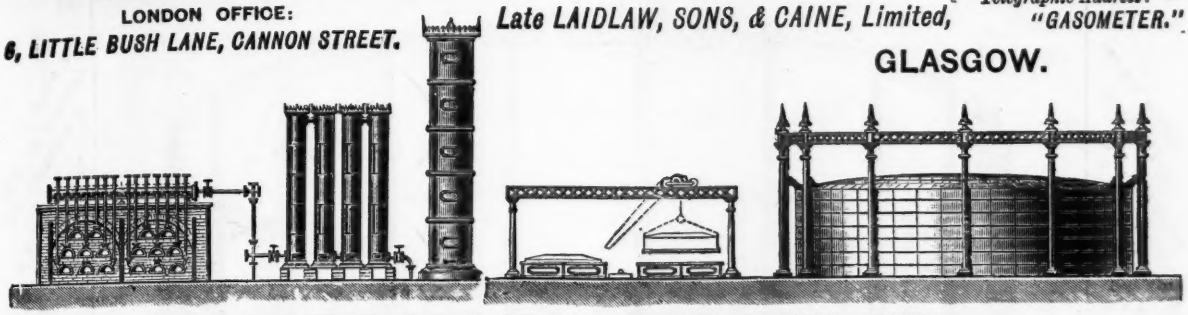

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RETORT-BENCH FITTINGS; SIEMENS'S REGENERATIVE AND ORDINARY FURNACES;
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MAKERS OF THE MOST IMPROVED FORM OF

GAS EXHAUSTING MACHINERY.

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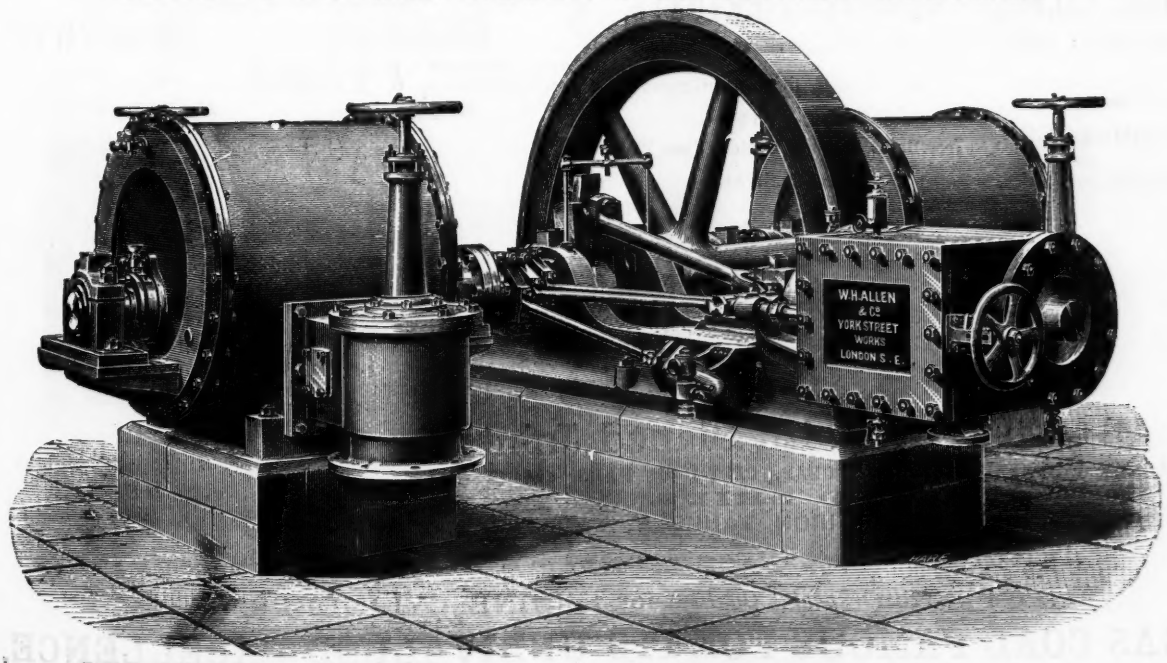

Pair of Non-Oscillating Exhausters, passing 200,000 Cubic Feet of Gas per Hour.

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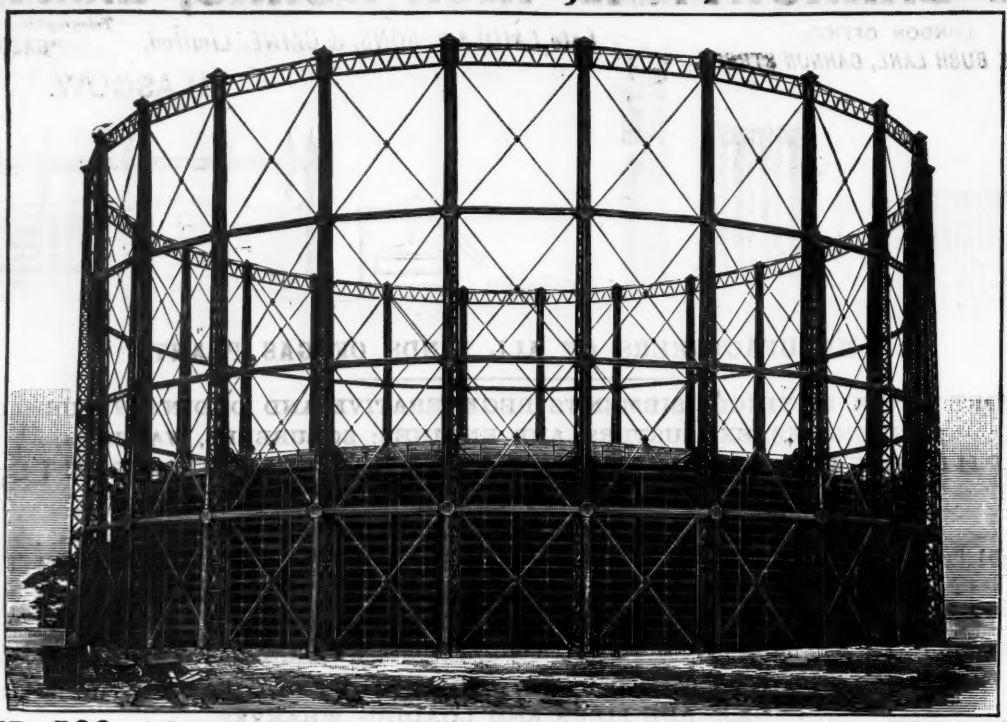

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REAL OLD SILKSTONE GAS COAL,

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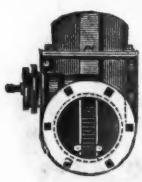

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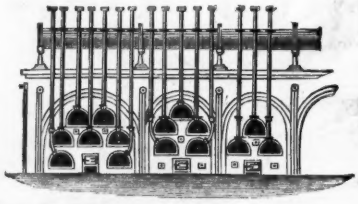
of every description,

Iron Roofs, Columns, Girders, Floor Plates and Tools, &c.



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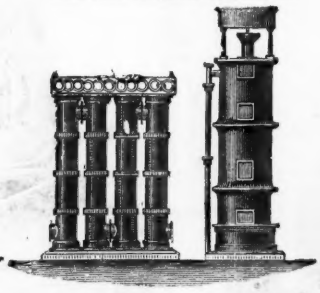

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for working Purifiers,

Also Bye-Pass & Stop Valves.

PURIFIERS with Planed Joints,

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WOOD GRIDS.

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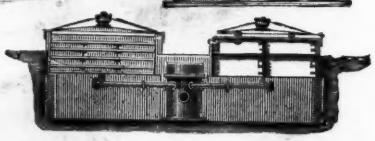

DESIGNS, SPECIFICATIONS, AND ESTIMATES FREE.

Pig Iron (*Special Quality*) for ENGINE CYLINDERS, &c.

GAS COAL FAMOUS FOR ITS UNRIVALLED EXCELLENCE.

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PURIFIERS with Planed Joints.

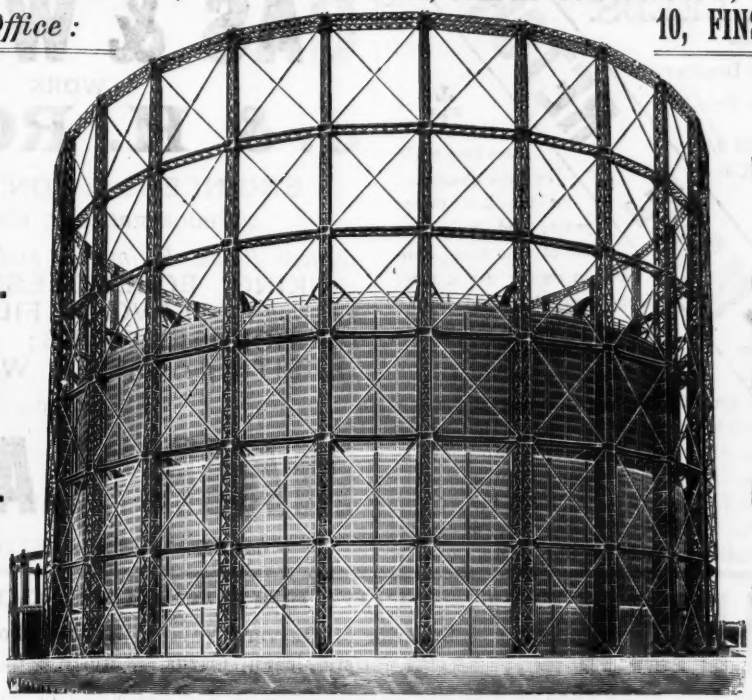
TOWER SCRUBBERS.

PURIFYING-MACHINES FOR AMMONIA.

CONDENSERS.

TAR PLANT.

SULPHATE OF AMMONIA PLANT.



GASHOLDERS.

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WASHER-SCRUBBERS.

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CENTRE & FOUR-WAY VALVES.

RETORT-MOUTHPIECES.

SLIDE-VALVES, TAR-BURNERS, SIEVES, &c., &c., &c.

The above is a view of the largest Gasholder (four-lift) of The Gaslight and Coke Company, Beckton, containing 8 million cubic feet, erected by us in 1892.

Sole Makers of **WECK'S** Patent CENTRE-VALVE, & **CRIPPS'** Patent HYDRAULIC MAIN VALVE.

THE AUTOMATIC GAS-METER CO., LTD.,

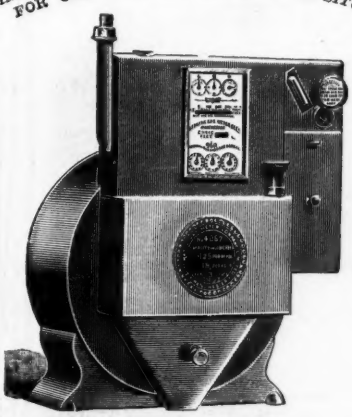
UPPER BROOK ST., MANCHESTER.

SOLE PROPRIETORS OF

THORP, MARSH, AND HAYNES' PATENTS.

PENNY-IN-THE-SLOT GAS-METERS.

THE AMOUNT OF GAS GIVEN IN EXCHANGE FOR COIN CAN BE ALTERED *IN SITU*.



The persistent efforts of the Inventors of our Meters have been crowned with

SUCCESS.

There can be no two opinions on the question of the priority of our claim to the consideration of Gas Companies as *the First* Introducers, on a Practical Scale, of a Penny-in-the-Slot Meter.

THE AMOUNT OF CASH PLACED IN THE BOX IS RECORDED. THIS IS A COMPLETE CHECK AGAINST FRAUD.

PENNY-IN-THE-SLOT GAS-METERS.

So long ago as 1889, we advertised our Penny-in-the-Slot Meters as having the now fully-recognized advantage of ability to alter **IN SITU** the amount of Gas given per Coin. Automatic Meters without Coin-Counting Index are liable to be tampered with.

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THE LEEDS FIRE-CLAY COMPANY, Ltd.,
WORTLEY, LEEDS.

LONDON Offices & Depôts:
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WHARVES NOS. 2 & 4, INSIDE G.N. GOODS YARD, KING'S CROSS, N.

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MACHINE-MADE RETORTS

Have been made in large quantities for the last twelve years; and during the whole of that time, have been in regular use at most of the largest Gas-Works in the Kingdom. They possess the excellent quality of remaining as near stationary as possible under the varying conditions of their work—a quality which will be appreciated by all Gas Engineers and Managers. The generally expressed opinion is that these Retorts are the very best that are made.

RETORTS CAREFULLY PACKED FOR EXPORT.

Fire-Bricks, Lumps, Tiles, &c., &c., of every description suitable for Gas-Works.

TELEGRAPHIC ADDRESS:
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GAS & WATER WORK

J. & H. ROBUS,

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20, BUCKLERSBURY, LONDON, E.C.,

furnish Plans, Estimates, and Specifications for SINKING BOREHOLES *and* WELLS; *Erecting* RESERVOIRS, FILTER-BEDS, *and* GASHOLDER TANKS; *and* EVERY REQUISITE *for* GAS *and* WATER WORKS,

INCLUDING

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EXCHANGE TELEPHONE 1756.

"CANNELINE"

FOR ENRICHING COAL GAS.

Superior to the very Volatile Hydrocarbons; requiring only a simple apparatus, at quite a nominal cost.

Coal Gas can be enriched by "CANNELINE," in our specially designed plant, at a cost of ¾d. per Candle, showing conclusively its vast superiority over all other Enriching Agents, including Cannel Coal.

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S. BOWLEY & SON, Wellington Works, BATTERSEA BRIDGE, LONDON.

R. DEMPSTER and SONS, Limited,

ROSE MOUNT GAS ENGINEERING WORKS,

Established 1855.

TELEGRAMS:
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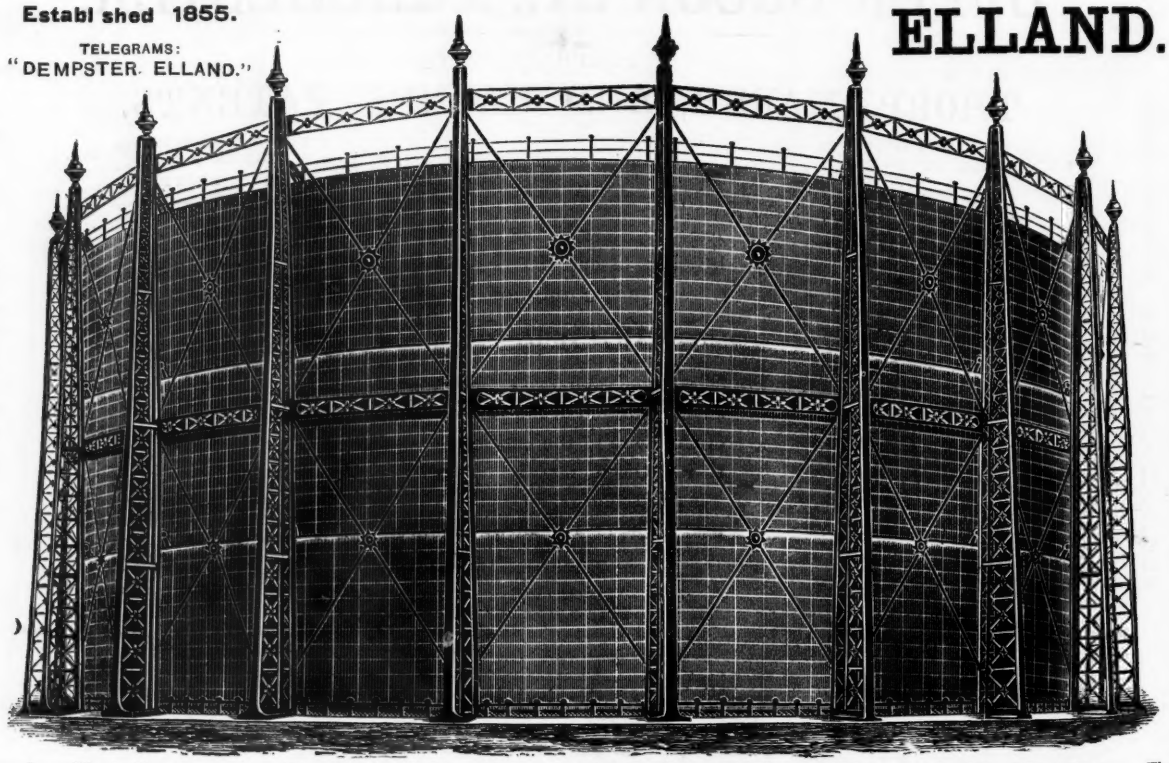
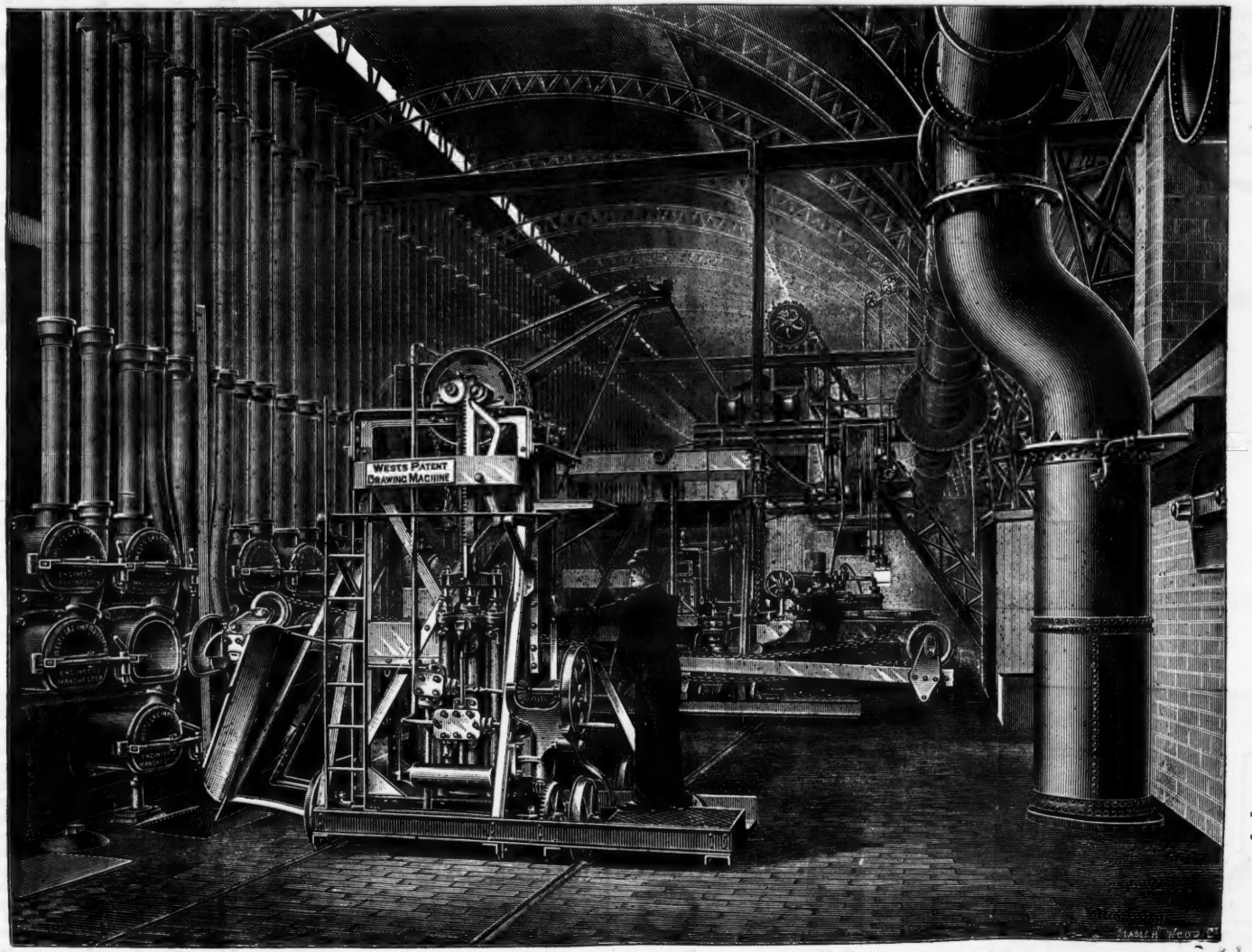


The above Illustration represents a Three-Lift Gasholder, 200 feet diameter, the Cups and Dips of which are made of Bent Steel Plates. The Tripods are of Steel, and braced together by substantial Wind Ties. The whole of the most improved and modern construction.

WEST'S GAS IMPROVEMENT COMPANY, LTD.,

ALBION IRON-WORKS, MILES PLATTING, MANCHESTER.

WEST'S MANUAL AND POWER MACHINERY FOR CHARGING AND DRAWING GAS-RETORTS.



Interior of Retort-House at the Bradford Road Gas-Works, Manchester, showing the Compressed-Air Drawing and Charging Machines.

OVER 560,000 LINEAL FEET OF RETORTS DAILY ARE CHARGED AND DRAWN BY WEST'S MACHINES.

KIRKHAM, HULETT, & CHANDLER'S,

PATENT LIMITED,

"STANDARD" WASHER-SCRUBBERS

These Machines are admittedly the most efficient of any in the Market, as evidence of which the fact is stated that 476 of them, equal to a daily capacity of 459,972,000 cubic feet of Gas, are in operation or in course of construction.

4 Machines, each for 3,500,000 cubic feet of Gas per day, erected at the Beckton Station of The Gaslight and Coke Company last year; 2 similar Machines erected at same Works this year.

Machines in hand for Silvertown, Devonport, Dorking, Accrington, Berlin, Marlborough (U.S.A.), &c.

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GEORGE ORME & Co.,

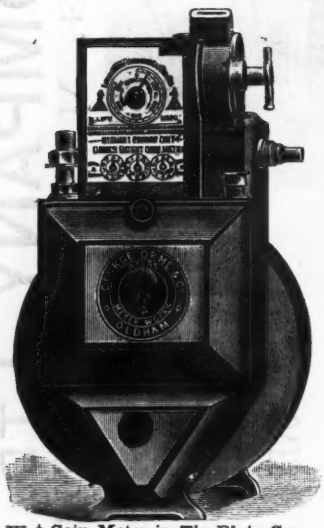
ATLAS METER WORKS, OLDHAM.

ORME'S PATENT COIN PREPAYMENT METERS.

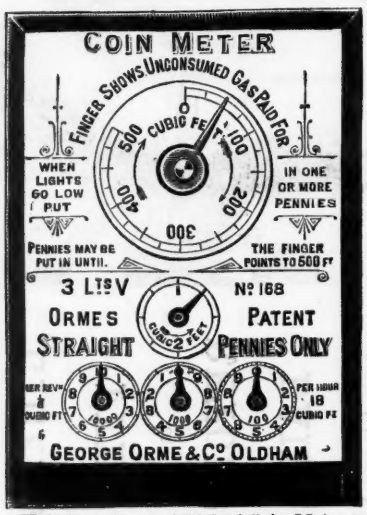
Wet Meters in Cast-Iron and Tinplate Cases. Dry Meters in Tinplate Cases.

NEW PATENTED ARRANGEMENT FOR ALTERING THE SELLING PRICE OF GAS.

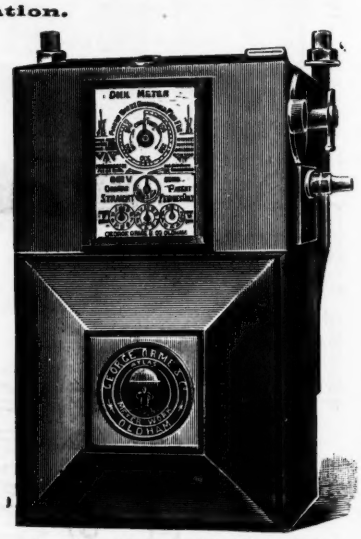
Full Particulars sent upon Application.



Wet Coin Meter in Tin-Plate Case.


COIN METER
FINGER SHOWS UNCONSUMED GAS PAID FOR
CUBIC FEET
WHEN LIGHTS GO LOW I PUT
IN ONE OR MORE PENNIES
PENNIES MAY BE PUT IN UNTIL
THE FINGER POINTS TO 500 FT
3 LIGHT ORMES STRAIGHT
No 168 PATENT PENNIES ONLY
GEORGE ORME & Co OLDHAM

Half-Size View of Dial of Coin Meter.

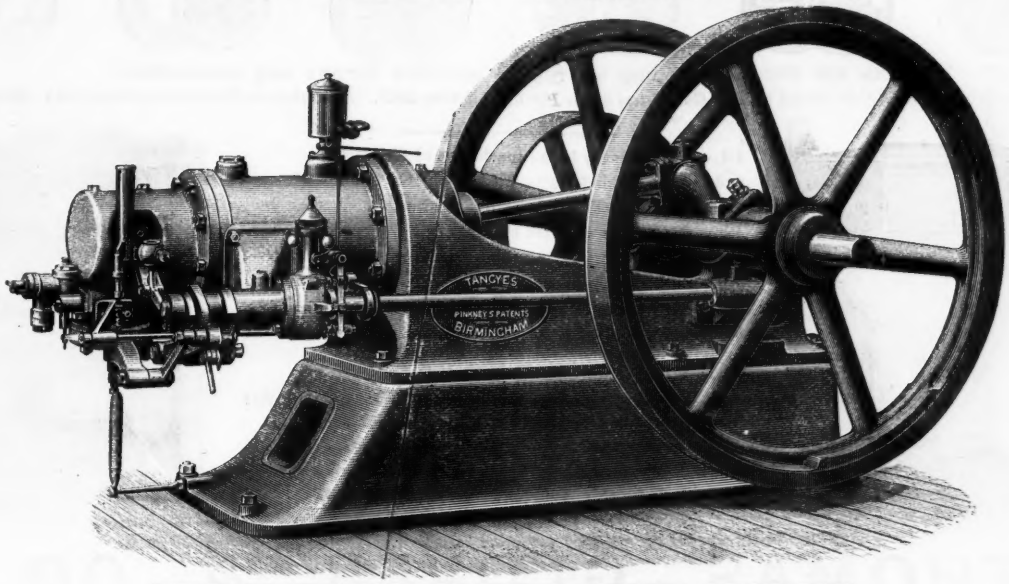


Dry Coin Meter in Tin-Plate Case.

Telegraphic Address: "ORME, OLDHAM." A.B.C. Code (4th Edition) used. National Telephone: No. 93, Oldham.

TANGYES GAS-ENGINE

"OTTO" PRINCIPLE. PINKNEY'S PATENTS.



THE 12-HORSE POWER (NOM.) ENGINE.

ENGINES OF ALL SIZES.

TANGYES LIMITED, BIRMINGHAM;

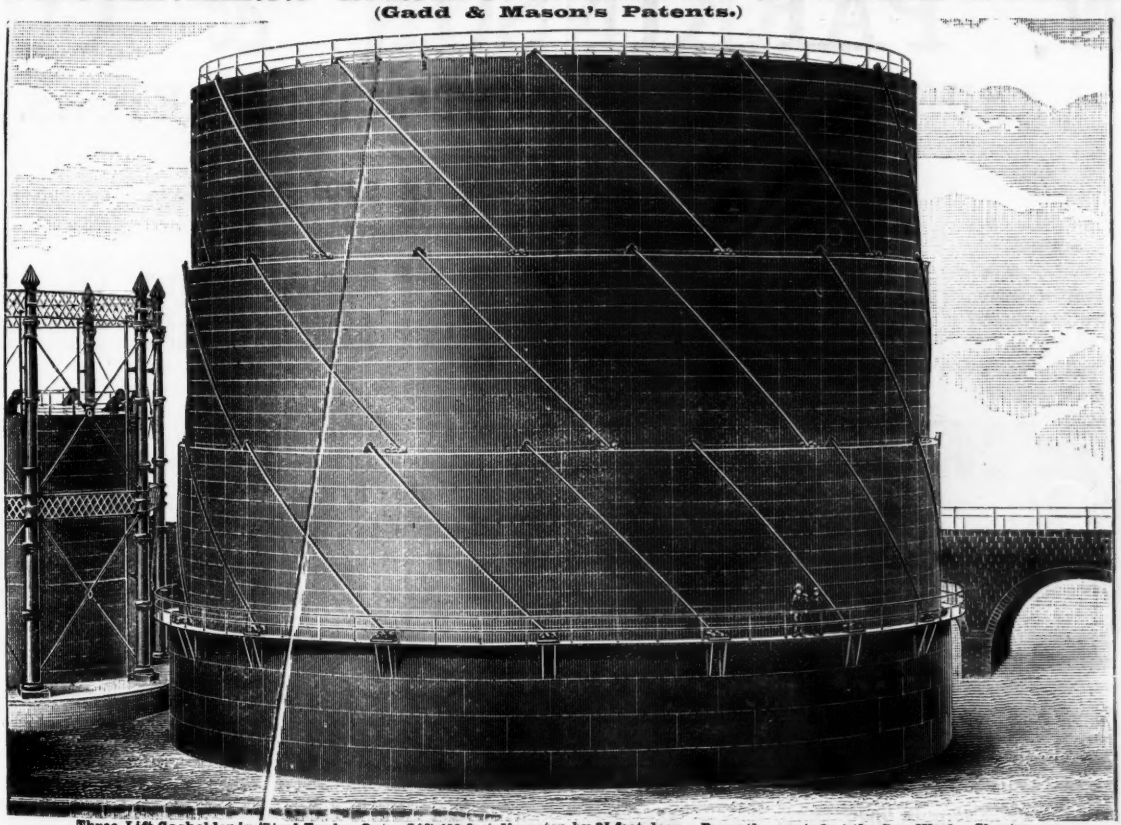
AND AT

LONDON, NEWCASTLE, MANCHESTER, GLASGOW, SYDNEY, MELBOURNE, JOHANNESBURG, BILBAO, ROTTERDAM, and CALCUTTA.

Telegrams: "TANGYES, BIRMINGHAM." No. 98 E.

COLUMNLESS GASHOLDERS WITH SPIRAL GUIDES

(Gadd & Mason's Patents.)



Three-Lift Gasholder in Steel Tank. Outer Lift 100 feet diameter, by 24 feet deep. Recently erected at the Gas-Works, Chester.

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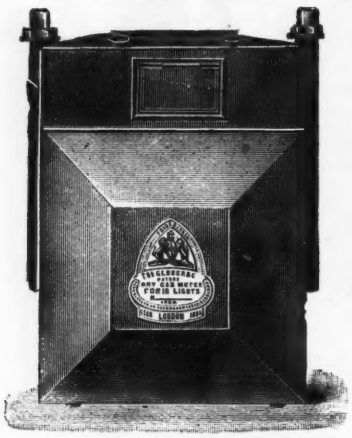
Newton Heath, MANCHESTER. London Office: 181, Gresham House, Old Broad Street, E.C.

[ESTABLISHED 1844.] **ORIGINAL MAKERS.** [ESTABLISHED 1844.]

LONDON, 1851. NEW YORK, 1853. PARIS, 1855. LONDON, 1862. DUBLIN, 1865 PARIS, 1867.

THE SIX MEDALS AWARDED TO THOMAS GLOVER'S PATENT DRY GAS-METERS;
The latter being the Highest Award for Dry Gas-Meters at the Paris Exhibition, 1867. Since then we have not Exhibited FOR PRIZES.



1st.—Are a remedy for all the defects of Wet Meters.
2nd.—Are suitable for all Climates, whether hot or cold.
3rd.—Incur no loss of Gas by Evaporation.
4th.—Cannot become fixed by Frost, however severe.
5th.—Are the most accurate and unvarying measurers of Gas.
6th.—Prevent jumping or unexpected extinction of the Lights.
7th.—May be fixed either above or below the level of the Lights.
8th.—Cannot be tampered with without visibly damaging the outer case.
9th.—Will last much longer than Wet Meters.
10th.—Will not cost more than one-half for repair that Wet or Water Meters do.
Are upheld for five years without charge.

Telegraphic Address: "GOTHIC LONDON."
Telephone No. 6725.

THOMAS GLOVER & CO.,

DRY GAS-METER MANUFACTURERS,

214 to 222, ST. JOHN ST., CLERKENWELL GREEN, LONDON, E.C.

BRISTOL: 62, VICTORIA STREET. *Telegraphic Address: "GOTHIC."*

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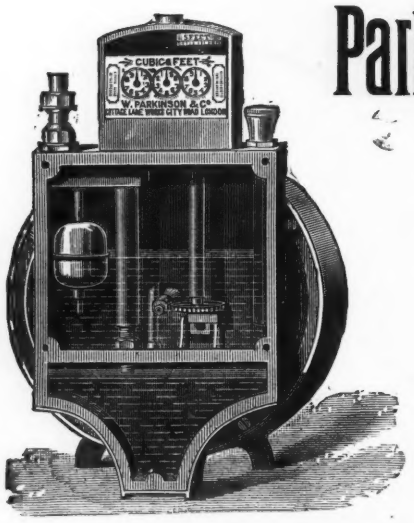

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(See also Advt. p. 116.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 10, 1894.

Tar Gas and Water Gas.

THE further instalment of our report of the papers and discussions at The Gas Institute meeting, which will be found in another part of the present issue of the JOURNAL, brings into publicity the perennial problem of the utilization of tar by carbonization. Current events and influences have led to the revival of interest in this question; and it is very remarkable that although whenever tar becomes unsaleable at what gas managers regard as a fair price, there is no lack of assertion, on the part of sundry energetic carbonizers, that they have at last succeeded in gasifying it to advantage, somehow the matter generally ends with the same. We believe it is the truth that at this moment there is no gas manager in the United Kingdom actually carbonizing the whole of his tar; and, with perhaps the solitary exception of Mr. Isaac Carr, of Widnes, it would be quite safe to say also that there is not a gas manager in the kingdom who would not rather sell his tar off at any price, from a penny per gallon upwards, than make any other use of it whatever. The impression created by such papers as that of Mr. C. Stafford Ellery is, in brief: What is the good of it? Can Mr. Ellery, or anybody else, make more than a shilling per ton of coal by gasifying his tar? If so, how much? Mr. Ellery states in his paper that, "assuming" 22s. per ton to be the present value of tar when used for gas making, the balance of advantage in using it for this purpose is to be found in the difference between this figure and the market price of the tar as sold out of the works. But is this quite the fair way to take it? Surely, there are firing, retort room, extra management, and many other charges to be taken into the account before the real cost of tar gas can be regarded as "liquidated and ascertained," as the lawyers say. It is at least certain that if the manufacture of tar gas is a profitable proceeding, the position of such gas managers as Mr. W. R. Chester—who maintained a discreet silence respecting this subject—and Mr. Alfred Colson is untenable. Surely, nobody would take the trouble to distil tar if it is worth more as a gas-making material.

We have already delivered ourselves of a hearty appreciation of the merits of Mr. Stelfox's paper; and it is therefore only necessary now to comment upon its subject-matter. In a sense, the problem of making carburetted water gas successful in any part of Great Britain has a connection with the problem of gasifying tar; for the believers in the latter idea make a strong point of asking why gas managers should send out of their works a fluid hydrocarbon for which they receive less than a penny a gallon, and buy a different article of the same class for twice or thrice the money. It is almost a sufficient answer to this argument to point out that this thing is done—say, at Belfast—because the two commodities are different. Mr. Stelfox gets his "Solar distillate" for about 2¼d. a gallon delivered, and uses from 3·10 to nearly 4 gallons of it per 1000 cubic feet of from 20½ to 26 candle power carburetted water gas. If he could obtain the same results from twice the quantity of coal tar with no more trouble, it might pay for doing. But this is not possible; and even if it were, there would not be enough of the material. With regard to Mr. Stelfox's water-gas working, it was pointed out by several speakers that he is very favourably situated for obtaining a cheap supply of oil, and also that, when everything is taken into account, this gas does not, even in his case, compare so very favourably with coal gas, in point of cost, as the paper makes out. Like most other experimenters in novel methods of gas making, Mr. Stelfox omits from his statements of the cost of carburetted water gas all the burdens which remain on the back of the main support of the Belfast undertaking—the common coal gas. This is all very well while one talks of an experimental plant; but when the talk is of actual working upon a strict commercial basis, all the charges should be brought into the account.

There is one other matter in respect of which we are able to support Mr. Stelfox, and yet another in regard to which we differ from him. There is every reason to believe that his confidence as to the cheapness of oil in the future is justified. People are apt to argue that increased demand for an article invariably tends to raise its price; but this is only the case when the supply is limited. When it is unlimited, the brisker the demand, the greater the facilities for satisfying it. We can see the operation of this principle of trade in the case of wheat, which was never so largely in demand in the world's history, and was never so cheap. It seems reasonable to believe that the supply of mineral oil suitable for gas-making purposes is practically inexhaustible by such undertakings as are capable of using it for this purpose. Hence the commodity may be trusted to diminish rather than to rise in price as the existence of this class of demand develops the trade. The other question is that of the existence of a public interest in the composition of the gas supplied to a community, from the

point of view of the risk of personal injury. Mr. Stelfox argues that the danger to the public from water gas is practically identical with that from coal gas. But what facts are known to bear upon this question are against his view. The risk may be a question of degree; but the degree is everything. People will die, as Mr. Stelfox says, from inhaling too much common coal gas; and they can but die, he argues, from inhaling carburetted water gas. It would be just as much to the point to argue that because a gallon of ale may be expected to intoxicate a man, he might as well drink a gallon of whisky while he is about it. The real consideration is that, whereas coal gas will suffocate, water gas poisons. Mr. Stelfox admitted that analysis of his carburetted water gas shows that it contains about 32 per cent. of carbonic oxide. This is not much for a Lowe plant; but even so it would prevent the arrangement from being worked in France, where not more than 20 per cent. of carbonic oxide may be legally sent out with an illuminating gas. And we are not yet prepared to accept the suggestion that it makes no difference to the British public whether their illuminating gas contains 10 or 30 per cent. of this ingredient.

Mr. W. J. Dibdin Denounces Low-Grade Gas.

THE campaign for low-grade gas has been hitherto restricted to the firing of salvos from certain big guns on one side, which have certainly succeeded in making no little noise in the technical world, and seemed to have hit their mark in the matter of the Plymouth skirmish. To abandon metaphor and return to plain language, the case which Mr. George Livesey, Mr. Thos. Newbigging, Professor Lewes, and—as he reminded readers of last week's JOURNAL—Mr. Charles Hunt, have committed themselves to uphold, has appeared from the outset to be plausible, and has likewise seemed to be strengthened by the now historical South Metropolitan experiment. Indeed, as recorded in these columns only last week, Professor Lewes regards the cause he has espoused as practically established by the results of that experiment. It was made manifest, however, at last Tuesday's meeting of the London County Council, that those who may have been disposed to take this view reckoned without Mr. W. J. Dibdin. On that occasion, three reports by that gentleman were received and put into circulation—one on the price of gas, another on Mr. Livesey's experiment, and the last on the existing testing arrangements; and in all three the redoubtable Chemist and Superintending Gas Examiner to the Council falls foul of the London Gas Companies and all their doings, especially the design to reduce the standard illuminating power of London gas. The principal portions of these reports will be found elsewhere. We are not particularly concerned just now to discuss Mr. Dibdin's first report, which is devoted to a statement, from the point of view of the chief Local Authority, of the position created by the disparity of the charges made for gas supplied to private consumers by The Gaslight and Coke and South Metropolitan Companies. His conclusion respecting this state of things is that it would appear to be impracticable to endeavour to bring about any alteration in the price of gas in the Metropolis, with a view to a uniform charge, without a preliminary independent inquiry, which would doubtless be of the nature of that instituted by the Board of Trade in 1873, which resulted ultimately in the institution of the sliding-scale. Mr. Dibdin admits that the question at present at issue is necessarily a complex one, and that an inquiry into it would be a lengthy procedure. Nevertheless, "in view of the "great commercial importance of the question, and the "advantage undoubtedly gained by the public on a former "occasion by the establishment of a sliding-scale," he thinks it would be well to move the Board of Trade in the direction specified. What a prospect for the experts!

The most salient feature of Mr. Dibdin's second report, on the South Metropolitan experiment, is the evidence it supplies of the results of this experiment, which have led the author to take up a position directly opposed to that of Mr. Livesey and Professor Lewes, and to urge upon the County Council that not on any account should this body consent to a reduction in the quality of the gas. Mr. Dibdin arrives at this opinion by considering precisely the same facts as those recognized by Professor Lewes—namely, the failure of the ordinary methods of enriching to reach the consumer; showing that, as Professor Lewes puts it, the consumer has to pay heavily for enrichment which only affects the results obtained at the testing-stations. Upon this showing, says Professor Lewes, enrichment should be dropped as a useless waste of money. Mr. Dibdin sees the matter differently, and urges that the failure of the consumer to benefit by enrichment as at present practised merely proves that the enrichment is not properly done. The point is well taken; and it shows how the same question may be answered differently, according to their lights, by different people. Mr. Dibdin goes on to declare that the reduction in the quality of London gas from 16 to 14 candles would be tantamount to increasing the price of the 16-candle quality by 4d. per 1000 cubic feet, having regard to the exigencies of the users of flat-flame burners. Instead of allowing the Companies to supply 16-candle gas to the testing-stations only, says Mr. Dibdin in effect, let us rather insist upon their distributing 16-candle gas throughout all the district of supply, looking up shortcomings by means of the portable photometer, which he almost goes out of his way to prove in every respect reliable. One can forgive this little piece of self-justification, seeing how long the portable photometer and Mr. Dibdin have been "inseparables." The third report is an outcome of the second, and carries the war into the enemies' country with a vengeance. It is concerned to prove that there are not enough testing-stations in London; and this is put forward as one reason why illuminating gas of low quality is found by the portable photometer in certain localities. It is especially the South Metropolitan Company that Mr. Dibdin accuses of getting off with too little testing; and he implores the County Council to stir up the Referees to take action in the matter forthwith.

Altogether, it must be conceded that these reports are a heavy attack upon the new movement in regard to the gas supply of the Metropolis; and we may expect lively times if anything should come of them.

"French Measurement" no Satire.

THE Editor of our estimable contemporary the *Electrician* is undoubtedly a clever man; but his recollection of the early days of the electric lighting industry in this country is slightly at fault. In a recent issue of that periodical, we find it remarked that "the satirist who once declared that "the American method of rating arc lamps consisted in "taking photometer readings for each of the cardinal "points of the compass, adding the quantities together, and "calling the sum the candle power, could scarcely have "supposed that, in the fulness of time, a real American "'electrical expert' would adopt this selfsame method of "specifying the candle power of a lamp." From this, taken in conjunction with a little story that follows, we gather that our contemporary is in ignorance of the historical fact that the trick in question was no invention of a satirist, but, under the style and title of "French "Measurement," was one of the principal devices whereby electric lighting companies hailing from the United States succeeded in imposing upon the British public in their "flush" times. There was no professed satirist, that we ever heard of, upon the staff of the Brush Company, who were the first to rate the usual arc lamp at 2000-candle power. A glance through the pages of by no means recent JOURNAL volumes will discover numerous references to the so-called "French measurement" of electric arc lamps. But, though denounced by some respectable electricians, the Brush Company stuck to their trick, finding it pay; and long after the origin of the valuation in question had been allowed to sink into the limbo of the unmentionable, its result—the so-called 2000-candle power lamp—retained its exaggerated rating, as indeed it does to this day. Many a street lighting contract in those early days was obtained by heaping upon the dazed understandings of the local authorities the immense figures alleged to be expressive of the superior lighting effect of arc lamps as compared with gas; and a hard task was ours to keep up with the promulgated schemes of "tower" and other fancy lighting, and expose the trickery on which most of them were based.

The Report of the Public Control Department of the London County Council.

THE annual report of the Chief Officer of the Public Control Department of the London County Council contains a mass of interesting particulars of the various ways in which—mostly quite unknown to itself—the Metropolitan public is "controlled" by the Spring Gardens authority. Among other things, the retail coal and coke trade is

supervised by the Council; and one of the best services this occasionally-maligned body has rendered to the community consists in the painstaking oversight of the ways of coal dealers and their servants, by which a vast amount of fraud of a peculiarly mean and cruel character has been checked. It is instructive to note that much of the work thus done by the Council in the public interest is pursued under the sanction of old Acts of Parliament, which had been allowed to fall into disuse. In one respect, the efforts of the Council to protect the consumer of coal are unfortunately balked. There is a law against selling coal for and as what it is not. But the difficulty is that the public never ask for a particular description of coal by any name that can be legally shown to belong to it; all house varieties being loosely classified as Wallsend, or Silkstone, or by merely the particular merchant's "selected." What is wanted is an authoritative list of proper coal names; but this is the very thing that dealers object to supply or be bound by. With regard to the sale of coke, the County Council officials think that, though there is an old Act requiring it to be sold by weight, "having regard to the fact that it is capable of "absorbing moisture to the extent of 30 per cent. of its "weight, it appeared to be undesirable to enforce this re-"quirement in the interests of the purchaser." Seeing that all coke purchased direct from the gas-works of London and the suburbs is now sold by weight, this seems a peculiar position for the County Council to take up. It is true that the dealers still prefer to quote coke prices by measure; but it would be asking too much of the credulous public to invite householders to believe that this is done in their interest. The regulation of the trade in, and the industrial use of, petroleum and mineral spirits is one of the responsibilities of the Control Department; and it appears to have been well discharged during the past year, if we may judge from the fact that for this period no fire occurred upon licensed premises where petroleum is used in trade. The tale is different in respect of the use of oil-lamps. The number of lamp accidents unfortunately increased during the past year; and the number which terminated fatally was also higher. The great majority of disasters of this kind are attributable to breakages of lamp reservoirs; but some are due to explosions. In all, 42 fatal lamp accidents, involving the loss of 48 lives, occurred in London during the past twelve months. This makes an average of nearly one death a week due to an easily preventable cause. Besides these fatalities, the Fire Brigade were called to attend at 456 fires which were reported to have been caused by lamp accidents. Not included in this number are a multitude of small fires reported to the insurance companies, where the Fire Brigade do not attend, and where the damage does not usually exceed £5. It is stated that these exceed in number all reported cases, which were no less than 3410 in 1893; and that at least one-half of them are caused by petroleum oil-lamp accidents. It is clear that if the damage, worry, and inconvenience thus caused were submitted to valuation, and the amount added to the cost of so-called cheap oil, the supposed economy of this means of lighting would suffer very marked depreciation. The question of smoke prevention is not overlooked in the report. But although it is confessed that the subject is yearly becoming a more serious one for London, owing to the steady increase of the number of dwelling-houses and business premises of every description, each with its contribution of smoky chimneys, it is said that the difficulty of dealing with the problem still appears insuperable. Not a word is said about gas in this connection.

Matthew Piers Watt Boulton, of Great Tew, Oxfordshire, who died on the 30th ult., at the age of 74, was the grandson and only surviving male representative in his generation of the once famous partner of Watt, whose works near Birmingham were associated with the adoption of coal gas as an illuminant and the introduction of the steam-engine. Deceased was a highly-cultured man; but, being naturally a recluse, his wide knowledge and sterling qualities were but little known.

The Cost of the Labour Commission.—In the House of Commons on Tuesday last, Sir J. Hibbert stated that the Labour Commission had cost £45,882 up to the present time; and it was estimated that £1253 would be still required—making a total of £47,135. This was exclusive of the rent of premises belonging to the Government, which would have amounted for the whole period to about £2592. The total is probably larger than has ever been expended on a Royal Commission.

WATER AND SANITARY AFFAIRS.

The recommendation of the Water Committee, brought forward at the meeting of the London County Council last Tuesday as "a matter of urgency," that eight separate Bills be prepared for the acquisition by the Council of the undertakings of the eight Metropolitan Water Companies, was carried by a considerable majority. Nine members voted for an amendment that, before the Council decided to introduce Bills for the acquisition of the undertakings, they should determine what method was to be proposed for settling the purchase-money. It is very certain that this question stands on the very threshold of any proceeding for the transfer of the undertakings. The Parliamentary Committee of the Council, in conjunction with three members of the Water Committee, are to prepare the eight Bills, "with a view to their introduction in the next session "of Parliament." But the approval of the Council must in some way be given to these Bills before they can be promoted. At present there is some obscurity as to the manner in which this is to be effected; it being simply promised that a copy of each of the proposed Bills shall be submitted to the members of the Council, "who would "then be able to learn what the actual conditions were." This does not commend itself as a very dignified or businesslike way of proceeding; and, on the whole, we seem warranted in concluding that the parties who are moving in this matter do not know exactly what they are about, or do not want anybody else to know. Only the other day the Water Committee proposed that there should be one Bill comprehending the whole of the Companies; and now they consider it necessary that there should be as many Bills as there are Companies, these Bills to be prepared first, and the principles settled afterwards. In 1880, the Purchase Bill brought in by the present Lord Cross covered all the Companies; details being furnished in schedules. But the County Council have no intention of adopting the simple and equitable plan devised in 1880. The *quid pro quo* forms no part of their policy. We have reason to believe that they do not propose to recognize any capital expended in the construction of works which have since been superseded; however necessary such constructions may have been at the time. The Council propose only to pay for just so much of the works as, in their opinion, is worth buying as it stands. Hence the actual expenditure shown by the capital account will not be accepted as a guide to the price now to be paid. So also there is no intention to enter into any arrangement which shall secure for the present proprietors a return equal to that which they now enjoy. The income derived from the several undertakings will not be looked upon as requiring an equivalent. Such principles as these being at the root of the County Council scheme, it is no wonder that the preparation of the Bills is to be conducted as quietly as possible. One thing is avowed, and it is this—that the statutory rights of the Companies, creating a monopoly, are to be set aside. If such a mode of "transfer" is to be sanctioned by the Legislature, capital will be rendered increasingly cautious how it trusts to Acts of Parliament.

The introduction of eight Bills in place of one for the acquisition of the water undertakings by the County Council, affords an example of reckless expenditure at which the Metropolitan ratepayer may stand aghast. The Parliamentary fees to be paid by the promoters of a Private Bill are considerable; and these will be multiplied eightfold by having eight Bills to do the work of one. In the House of Commons, the scale of fees for a Private Bill, by the time the third reading has been reached, amounts to at least £75. But certain of these fees, amounting to £65, are increased "according to the money "to be raised or expended under the authority of any Bill "for the execution of a work." If the sum be £1,000,000 and above, the amount of these fees is multiplied fourfold. Should this rule apply to the raising of money to purchase existing works, it follows that there is only one of the Metropolitan Water Companies whose capital expenditure is low enough to have merely a threefold multiplication of fees. We may suppose that the County Council have no intention of raising a sufficient sum to repay the capital expenditure. Still we may look for an approximation; and there seems to be a risk that this will

entail a proportionate increase in the amount of the fees. After the Commons will come the Lords; and it will be interesting by-and-bye to have a fair estimate of the enormous and unnecessary cost thrown upon the ratepayers by the plan which the County Council have seen fit to adopt. Of course, there is one consideration which may have something to do with the scheme of a Bill for each Company. It is that the Council may thereby be in a better position to buy up one or two Companies, and leave the rest alone. But there is the least possible chance that Parliament will allow so unfair a proceeding. In the meantime, we confess to considerable curiosity as to the form which the eight Bills will assume. We expect to find sundry changes rung upon the octave; and already the sound is very much like that of the "Eight "Bells" which so often figure as a public sign. The latest development of the affair consists in the waking-up of the Water Committee to the fact that the projected Bills will affect many districts outside the limits of the county of London. Hence it is proposed that a conference shall be invited with representatives of extra-Metropolitan authorities, "for the purpose of discussing the various "matters which will necessarily have to be settled." This proposal is to come before the Council at their meeting to-day.

Mr. Harold A. Barnes, B.A., of Farnworth, has accepted the seat on the directorate of the Farnworth and Kearsley Gas Company, vacant by the death of Mr. J. Warburton.

The Netherlands Photometry Commission.—We have received from the Secretary of the above Commission (Mr. D. Van der Horst) copies of their report, which we hope to notice at greater length in a subsequent issue of the JOURNAL. It is an excellently printed octavo volume of 164 pages of letterpress and 46 plates; and it is published by Mr. P. W. M. Trap, of Leyden.

Gas Traction for Tramcars.—A further trial of the gas-driven tramcar noticed in the JOURNAL for the 26th ult. (p. 1233) was made last Friday on the line of the Thornton Heath and Croydon Tramways Company, in the presence of members of the Tramways Institute of Great Britain and Ireland and representatives of provincial tramway companies. The trial was quite successful; the slight odour detected on the occasion of our visit on the 19th ult. being absent, and the car running smoothly.

Presentation to Dr. Tilden.—Past and present students of the Mason College, Birmingham, recently presented to Dr. Tilden a silver bowl and a congratulatory address on his removal to the chair of Chemistry at the Royal College of Science, and as a mark of appreciation of his long and honourable career in connection with the College. In the course of his reply to the address, Dr. Tilden remarked that, under the care of his successor, Dr. Percy F. Frankland, the work of the College would, he had no doubt, advance in the right direction.

London Municipal Society.—The objects of the organization recently formed under the above title were definitely resolved upon last week. They are: (1) To complete and extend the policy successfully promoted by the Unionist Ministry of 1886-92 for the reform of London government and the advancement of the social well-being of the people. (2) To bring municipal and social questions under public consideration and discussion, with a view to the framing of measures of reform. Foremost among the reforms indicated are the simplification, consolidation, and improvement of the machinery of local government; and the revision of the present system of local taxation, by requiring the owners of both real and personal property to bear a fair proportion of local expenditure. The Society is receiving the support of all sections of the Liberal Unionist party.

The Lighting of Paris.—In a handsome volume of 500 pages, with 211 engravings, which we have just received from the publishers (MM. Baudry et Cie., of Paris), M. Henri Maréchal, Engineer of the Ponts et Chaussées, and Municipal Engineer of the City of Paris, gives a highly interesting account of the different methods of lighting the French capital. We cannot do more, on the present occasion, than briefly notice the issue of the work, which is of sufficient importance to justify a detailed review. Suffice it to say now that most of the chapters are naturally devoted to gas and electricity; and the production and utilization of these illuminants are the subject of close investigation. The illustrations show the different kinds of burners employed in the public lighting, as well as the lamp-posts, which, as visitors to Paris are aware, are remarkably fine and well kept. A chapter is devoted to the distribution and sale of electricity; prices being given. Of course, the relations between the Municipality and the Gas and Electric Light Companies are carefully explained. A very interesting chapter is the last, in which the author deals exhaustively with the lighting of the public thoroughfares. M. Maréchal's work will repay attentive perusal by all who are interested in outdoor illumination.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-FIRST ANNUAL GENERAL MEETING,

HELD AT THE

WESTMINSTER TOWN HALL, JUNE 19TH, 20TH, & 21ST, 1894.

JOHN WEST, ESQ., M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

We continue to-day our report of the technical portion of the proceedings at the above meeting by giving the discussions on the papers read by Messrs. Stelfox, Hill, and Ellery—the first of which appeared in the JOURNAL for the 26th ult. (p. 1225), and the others in the last number—together with the papers, by Mr. T. Travers, Mr. T. S. Cleminshaw, and Mr. W. Chew.

DISCUSSION ON MR. STELFOX'S PAPER ON "A FIRST SEASON'S EXPERIENCE OF CARBURETTED WATER GAS."

Mr. G. ANDERSON (London) said he should like to ask Mr. Stelfox whether he found any difficulty in the coal gas and the other gas being made and supplied at the same time—whether it caused any deficiency in the illuminating power, or whether there was any difficulty in mixing them as an article for sale.

Mr. J. CHEW (Blackpool) asked if Mr. Stelfox anticipated any difficulty from the workmen neglecting the apparatus at certain stages of the heating, and so producing inferior gas, and contaminating the whole of the gas in the holder. He feared something of the sort might take place in the hands of careless workmen. He understood Mr. Stelfox to say he had a separate holder for this purpose; but this might not always be convenient to other people.

Mr. STELFOX said it was only a regulating holder. Gas was always going in at the same time that it was coming out; it was like passing gas to the town through a governor.

Mr. CHEW said this led him again to the question of overheating the apparatus. Did Mr. Stelfox anticipate that at any time the apparatus might be overheated, and produce an inferior quality of gas in the holder? Next, did he find any evil effects from the carbon monoxide, or poisonous gas, which was the result of the process? He (Mr. Chew) thought of introducing a similar system for the same purpose as Mr. Stelfox—viz., producing a large quantity of gas in a short time, when there was a sudden demand. In the present state of the labour market, labour was the greatest difficulty gas men had to contend with; and very often the production of a considerable quantity of gas in a small space of time was of the first importance. Personally, he felt under a deep obligation to Mr. Stelfox for his very able paper.

Mr. J. BOOTH (Southport) said perhaps some members would think that the very valuable paper before them ought to be taken "with a grain of salt;" but he could certainly commend it to their very best consideration. Some two or three months ago, Mr. Stelfox, when at Southport, called upon him, and explained the plan he had introduced, which set him quite on the *qui vive* that he would be able to obtain such very wonderful results. Consequently, three weeks previously he went to Belfast to look at the plant; and the extreme simplicity with which it was worked commanded his highest admiration, and he could confirm all Mr. Stelfox had said. Only in the preceding week, in company with some members of his Committee, he was at the Beckton works, and he also visited the Kensal Green works of The Gaslight and Coke Company, to see the water-gas plant in operation there. The Belfast plant was an improvement on that in London. From the information he gathered from the respective engineers, the plant in London was giving every satisfaction; and, as he understood, they were doing their enrichment (and since this plant had been introduced no cannel had been used) free of cost. He had recently put up an installation of the Peebles oil-gas plant, which he believed was the largest at present in England. This had been working a short time;

and he thought he should be able, although he could not give the figures, to produce gas as cheaply as Mr. Stelfox. He had to supply gas of 22-candle power. The advantage that struck him with water-gas plant was the very greatly reduced expenditure required on capital account. When Mr. Stelfox named the matter to him, he had under consideration the question of erecting a new gasholder. But it occurred to him that, with plant of this character, he should be able to do without one; for the plant required for (say) half a million cubic feet of water gas per day would not cost half so much as a gasholder and tank.

Mr. C. Stafford Ellery (Bath) remarked that, though personally he had had little experience of water gas, there were some points he should like to mention in connection with it, in the hope of having the matter further elucidated. The paper before them was about the most valuable statement that had yet been published in connection with water-gas making; and those who had sudden very large and unexpected demands for gas in winter would be grateful to Mr. Stelfox for having given so much clear information on the subject. He thought it would be helpful if the author could give them an analysis of the gas. He found it was suggested in the paper that three months' supply of the maximum consumption of coal was not too much for safety. But though some might have coal storeage for three months' maximum supply, in making a calculation many would have to take a very much smaller quantity of coal than this, which would, to some extent, affect the figures for capital expended. It was probably too soon for Mr. Stelfox to inform them, but there must come into the calculation the cost of renewals. Plant of this kind would, he imagined, entail considerable expense for renewal.

Mr. Stelfox said this was included in the figure of 0·5d. per 1000 cubic feet.

Mr. Ellery said he found it suggested in the paper that it might pay better to leave the carbonic acid in the gas at the expense of two candles illuminating power; but he (Mr. Ellery) threw out the suggestion that possibly they derived a greater benefit from removing the carbonic acid than was shown by the photometer. He thought the flame produced by gas which was free from carbonic acid was superior to that when this impurity was present. He did not know whether or not the author had given the point any attention; but, as he suggested leaving the carbonic acid in, and using a little more oil as an equivalent, he would perhaps give his views on that subject. Mr. Stelfox had not told them the percentage of ash in the coke that was being used. In some works, the coal produced a very large percentage of ash; and this must affect not only the cost of making the water gas, but also the difficulties of clinkering. Mr. Stelfox had spoken with great confidence as to there being no risk of the supply of oil becoming exhausted. But was it not a fact that in many American localities it was already running short? and if it was used in any very considerable quantities from the Baku district, he did not know why they should have greater confidence in that than in the American wells. It seemed to him that this would be a point which must receive attention from time to time, as water gas was more extensively used.

Mr. A. Mead (London) said that for the past six months or more he had been associated with the manufacturers of an improved Lowe carburetted water-gas plant having a strong family likeness to that which Mr. Stelfox had so ably described, except that, with other dissimilarity, they had dispensed altogether with one vessel, and accomplished the same work with two only, instead of three, and also with a saving of fuel. Mr. Stelfox had said that he made 22-candle gas with a generator fuel account of 41·465 lbs. per 1000 cubic feet of gas. The plant he (Mr. Mead) was now working had for some time produced 1000 cubic feet of gas with as little as 30 lbs. of generator fuel; and a recent improvement had been introduced by which this consumption had been still further reduced to as low as 25 lbs. of fuel He thought it was very satisfactory to the advocates of carburetted water gas to find that this water-gas business had been brought before gas makers in the forcible manner it had been by Mr. Stelfox. He (Mr. Mead) had been looking forward with great interest to the paper, and had prepared some notes upon the subject; but he found the words were completely "taken out of his mouth" by the paper, and by the remarks which had already been made. There was one matter which had not been referred to in the paper, because, as Mr. Stelfox had stated, he was dealing solely with his own case. But he might mention that the system and plant with which he was identified could be adopted in works as small as those having a maximum daily make of 250,000 cubic feet, or even less, as well as in larger works—in fact, it could be adopted with advantage apart from size, and could be erected and worked upon a space not larger than 20 feet square. He had recently been negotiating for a plant with some gentlemen who were as cramped for space in their works as Mr. Stelfox, one of whom was compelled during the past winter to have nearly 50 per cent. more retorts working than were necessary, in consequence of inadequate storeage; and he had no doubt that he would adopt the proper course, and erect water-gas plant—thus supplying an immediate want—and possibly dispense altogether with an additional gasholder. With regard to carbonic oxide, this, together with financial complications, had given water gas a bad name during the last few years; the idea being that all water gas was inodorous, highly poisonous, and therefore to be avoided. But he should like to point out that the analysis of carburetted water gas was practically identical with that of ordinary coal gas; and, so far as danger from escapes was concerned, it could be as easily identified and dealt with, and exactly in the same manner. He hoped this old "bogey," as well as that of cost, had been disposed of entirely. He would also remind members that, unlike the ordinary "enrichers," carburetted water gas was not a gas produced, put into a holder, and afterwards enriched, but that—in his plant, at any rate—production and enriching were both accomplished in the same plant, and at one and the same time.

Mr. W. R. Chester (Nottingham) stated that there had always been one special difficulty in his mind in connection with the introduction of water gas, and that was the obligations that the purveyors of gas put themselves under in changing from the supply of coal gas to that of water gas. Nearly all undertakings were under statutory obligations which authorized them to sell to the public gas manufactured from coal. Now, if they supplied water gas containing something like 30 or 40 per cent. of a very poisonous compound—carbonic oxide—it had always struck him as placing the suppliers under a very serious responsibility if any poisoning accidents should happen to occur from its supply. He did not know whether or not Mr. Stelfox had considered this point, and whether he would not lay his Corporation under a very serious liability to damages, to which they would hardly care to be subjected. Another point struck him with regard to the cost of production, which appeared to be equal to 14d. per 1000 cubic feet into the holder. Of course, the illuminating power of the gas was something higher than could be obtained from the ordinary carbonizing of coal; but it seemed to him to be a question whether this water gas was not costing Mr. Stelfox something more than 1d. per 1000 cubic feet higher than the price at which he could manufacture ordinary coal gas. In his own case, to manufacture gas at 14d. per 1000 cubic feet into the holder would be more than his expenditure under the ordinary system; and if this were so, he did not quite see where the great advantages came in. It was very nice to be able to turn on a tap and obtain 1000 or 1,000,000 cubic feet of gas at a few minutes' notice. But, as a matter of fact, there was not much difficulty, in a well-organized gas-works, in regulating the make to the actual demands; and if they could supply this gas at a lower cost than that at which they could make water gas, he did not quite see the object of adopting the latter method.

Mr. C. A. Craven (Dewsbury) remarked that Mr. Stelfox had expressed his confidence that, if more oil could be used, the price would be lower, or certainly not higher; but he (Mr. Craven) thought this was only on an hypothesis which might not be justified. If the Americans had their finger in the business, his idea was that, when there was a good demand for oil, instead of being 2¼d. or 2½d., it would more likely be 4d. per gallon; and this would put a very different complexion on the figures.

Mr. Frank Wright (Westminster) said that he had a very great prejudice against the introduction of water gas in place of coal gas, in the same way as he had a great prejudice against spurious gold getting into his pockets. His father, the late Alexander Wright, very early in the days of gas lighting showed the soundness in policy of supplying gas of good quality. One gentleman had raised the question of carbon monoxide. With regard to this, he might say that Mr. Stelfox, himself, and three other gentle-

men, were the greater part of three days in a small hut 8 feet by 10 feet, and 8 feet high; and they never noticed the slightest effect on their nasal organs. There were two flames burning—one at the Methven screen and the other at the burner under test. He could also testify to the marvellous regularity of quality in the gas. Throughout the whole day, there was not more than half a candle difference in any one run. It was only right that these facts should be known. It must not, however, be taken that he was advocating water gas. He believed that statutory gas undertakings should supply coal gas of good quality; but he did not believe, if they took up this gas, that they would kill off half the population, or that they would be mulct in the heavy damages referred to by Mr. Chester.

Mr. T. O. Paterson (Birkenhead) said that, though he was not working under the same difficulties as Mr. Stelfox with regard to his supply, he certainly did want an extension; and, in view of water gas coming to the front, he went to Belfast, and spent a very pleasant day at the gas-works there. He was very much struck with the simplicity of the whole arrangement, and with the quantity of gas which was produced with apparently a very small amount of labour. It appeared to quite revolutionize the whole idea of producing gas at so much per mouthpiece. The house wherein 800,000 cubic feet of gas per day were being made seemed quite quiet. Three or four men manipulated the whole thing, with the exception of the rather laborious part of clinkering the furnace once in twelve hours. For doing this, a few extra men were brought in, and were allowed one hour's pay for it, although the whole operation was performed in 14 minutes. With regard to the cost per 1000 cubic feet, he thought no ordinary coal process could touch it. Mr. Chester seemed to think that coal and cannel gas could be made as cheaply; but he (Mr. Paterson) did not see how he could manage it. Even 14 or 15 candle gas could scarcely be made for the same money that 21-candle gas was produced at by this process. There was no doubt that the paper before them would be referred to in future with very great benefit.

Mr. W. Carr (Stalybridge) said that Mr. Stelfox had certainly made out the best case for water gas which had yet been put forward. No doubt his circumstances were exceptional; and if he (Mr. Carr) had been in his place, he should have done as he had. Going through the figures of the cost, he agreed with Mr. Chester that the cost was not low; and the system could not be recommended on account of cheapness. Gas of the quality stated could be made at less price than that at which he was making it. Again, they had to consider the fact that Mr. Stelfox was exceptionally placed in being able to get ships close up to the works. They had the Ship Canal to Manchester, no doubt. This, however, would not put oil within the reach of the provincial towns of Lancashire and Yorkshire; and when they considered the cost of the water-gas system in comparison with others, they would have to take into account the carriage of the oil. With regard to the poisoning of the community, this only arose when the gas escaped unconsumed. When it was burnt, it was not more injurious than any other.

Mr. A. Gibb (Newry) said he had had the privilege of going with Mr. Stelfox through his works, and seeing the process in operation. The simplicity with which it was carried on, and the regularity with which the gas was delivered, were to him very remarkable. He thought the "bogey" about the carbonic oxide would very soon die a natural death; a great deal too much had been made of it. As regarded the cost, some managers in England were living over the coal-beds; but they must make some allowance for people situated in Ireland, where they were a considerable distance from coal, and where it could not be delivered so cheaply as in England. Another important matter was that the area of production was reduced to a minimum with water gas, and contrasted very remarkably with the area of ground occupied by the production of coal gas enriched with cannel. Labour was another very important factor in the production of water gas. No great skill was at all requisite—any careful, steady workman sufficed; and the work was not so onerous or difficult of achievement as with an ordinary retort.

The President said Mr. Stelfox had laid before the meeting, entirely ungarnished, the results of his practical working of the water-gas process, which were the best of the kind he had heard of. But in making comparisons they must consider the circumstances of the localities.

Mr. Stelfox, in reply, said he had not so much to answer as he had expected. He was afraid he might be asked some very difficult questions which he would not be able to answer, for at the present time he was only an "improver" in water-gas matters. With regard to the lamination to which Mr. Anderson had referred, he had not detected any tendency in this direction. Last year he put up a large meter, and so arranged the connections that he could separate the water gas so as to get all the information possible about it. Had this not been done, he should hardly have been inclined to form so high an opinion of the system, as he should certainly have attributed some of the results to the coal used in the ordinary retorts. The water gas came to this meter without any admixture of other gas. When not working experimentally, the water gas was discharged from the outlet of the meter into the common inlet to the gasholder, and thus became intimately mixed with the other gas. When working experimentally, the water gas was discharged into one gasholder, the contents of which were afterwards worked back into the common inlet to the gasholders. The tests were made continuously while the holder was being emptied; and the time occupied in the latter operation was about three days. The tests were continued until the gasholder was practically empty; but he had not been able to detect anything like lamination or deterioration. Of course, the fact of the gas passing through the little holder referred to by Mr. Chew aided in the thorough mixture of the gas. The make passed in by one pipe, and was taken away by the exhauster from another; so that the gas had a good chance of tumbling about and mixing in this little gasholder. Subsequently it had to pass through exhausters and scrubbers; so that a thorough mixture took place. There was no difficulty on this score. With regard to the carbon monoxide, he never took the least notice of it. He did not think that they, as dealers in a certain article, ought to quarrel with other people who made it a little stronger. It was like one publican who sold whisky-and-water objecting to another for selling plain whisky. They were all selling an article which, if inhaled in any quantity, would asphyxiate and kill people. In his own neighbourhood, a short time ago, two persons were killed in their own house by coal gas; and only in the previous week three people were suffocated in Glasgow by cannel gas. Therefore he did not think there could be any serious question raised as to the more objectionable composition of carburetted water gas. Gas people did not make their vilely-smelling compounds for people to inhale. On the contrary, they gave them the earliest possible warning; and he could not understand anyone continuing to use an apartment when there was a smell of gas. In was only in case of an accident—such as leakage from a broken main, or some such mishap—causing a large influx of gas into a sleeping apartment, that he could see any risk from either gas. In such a case, undoubtedly the material which was weakest in carbon monoxide would kill its victims; and the presence of a little more of that constituent could not kill them any "deader." Mr. Ellery had inquired about the composition of the gas. He (Mr. Stelfox) had asked their chemist, who was deeply interested in the work, to make experiments from time to time; and the average results of eight tests had been—

Carbonic acid	none.
Oxygen	none.
Unsaturated hydrocarbons	10·7 per cent.
Carbonic oxide	31·9 ,,
Saturated hydrocarbons	16·2 ,,
Hydrogen	33·7 ,,
Nitrogen	7·5 ,,
	100·0

The amount of carbonic acid in the foul gas lately had been only about 3½ per cent.; but at one time it was as much as 7 per cent. Whether or not it was desirable to take out the carbonic acid was, he considered, a very open question. He did not think he had spoken very confidently about it. He had only suggested that it might not be worth while to remove it, because the loss of illuminating power by leaving it in could be so cheaply made up by the use of a little more oil. The largest amount of sulphuretted hydrogen found in the foul gas had been 0·2 per cent.; and this, strange to say, was during the last experiment, when using refined oil. When employing the Russian "Solar distillate oil," it was only 0·05 per cent.—a quantity so small that it only meant a trace. It occurred to him that the process of purification would be

very much simplified if he were to be content with merely taking out this trace of sulphuretted hydrogen, and letting the other go forward. This would be a matter for future consideration. Mr. Ellery had also asked whether he (Mr. Stelfox) found any condensed vapour in the street mains. He could not trace any increase in the deposit in the syphons. He at one time thought of asking the syphon men for a return. But he need not tell the meeting that this process was not popular with some men; and he considered it better not to suggest the difficulty, lest it should be promptly found for him. He thought, however, that he should have heard of it if any trouble had been experienced. He had not heard of it, and had no reason to believe that it existed. Even in the works, where he often saw the syphons between the condensers and the exhausters pumped, there was nothing more than was to be seen in their own regular syphons. The coke used would give about 4 per cent. of ash. But, from tables lately published, it would seem that in Glasgow they were using coke containing about 20 per cent. of ash; and the results, as regards fuel used in the generators were rather better than those he had been able to give. This, however, had something to do with the larger quantity of oil employed per 1000 cubic feet. In Glasgow they were making upwards of 30-candle gas; and, of course, the richer the gas made, the better would the fuel account show. Mr. Mead had referred to the 41 lbs. of fuel per 1000 cubic feet; but he (Mr. Stelfox) must remind the members that, while giving the figures actually obtained in the experiments, he had told them that he had realized higher results, and hoped to do better still. They had done as well as 33 lbs. in the early stages of the work; and he thought the reasons given in his paper were quite sufficient to account for the difference. There was only one other point of importance, and that was the one raised by Mr. Chester and Mr. William Carr. He did not know what they meant by saying that the cost into the gasholder was not a low one, because he had before him a complete list of all the figures relating to the cost of gas in various works for two years past, as published in Field's "Analysis." It must be remembered that the London Gas Companies, and some others, derived great benefit, in the latter half of the year, from the high price realized for coke during the coal strike, while at the same time their contracts were such that they had not to pay an increased rate for their coal. Their figures for 1893 were, therefore, not normal. Nevertheless it would be seen that The Gaslight and Coke Company's 16½-candle gas cost them 16·03d. into the holder; and the South Metropolitan, Leicester (by a mere shade), and Newcastle-on-Tyne were the only cases recorded in Field's "Analysis" which came slightly better than the figures he had given, and that for gas of much lower illuminating power. Mr. Chester was down in the list for 14·23d. and 13·96d., for 1893 and 1892 respectively, for 19-candle gas; and yet he understood Mr. Chester to say that he could beat the prices he (Mr. Stelfox) had given.

Mr. Chester (interposing) said the figures just given comprised items which were not contained in the paper. They included all managerial charges, rates and taxes, and other things which Mr. Stelfox had entirely ignored. His price merely represented the cost of manufacture on the works—viz., carbonizing wages, the cost of coal, and so on; and that cost was lower by several pence per 1000 cubic feet than Mr. Stelfox showed by his water-gas plant, where there were no residuals.

Mr. Stelfox said, of course, the cost of gas was that of the finished gas, no matter whether or not this was assisted by the sale of residuals. No doubt Mr. Chester's workings were very low; but he (Mr. Stelfox) still maintained that the figures he had given were much lower, and included every item of cost except the trifle for management. He was much obliged to the meeting for giving him such a patient hearing.

Discussion on Mr. H. Ashton Hill's Paper on "Gas Manufacture at Wallasey, with Special Reference to Enrichment by Cannel."

Mr. H. Lees (Hexham) said there were one or two matters in the paper on which some of the members would like a little further explanation. Mr. Hill told them that his results were briefly as follows: The gas made per ton of coal was 11·517 cubic feet of 19·42-candle quality; coke, 12 cwt.; and tar, 16·83 gallons. He found, in working out these figures, that the weight in tar was 185 lbs; in coke, 1344 lbs.; and taking the "virgin" liquor as 10 gallons per ton of coal, it made 1629 lbs. of solid and liquid products—leaving 611 lbs. for the gas, or 27·3 per cent. of volatile matter. This seemed a very small percentage of volatile matter to give 11,500 cubic feet of gas per ton of coal; and it would be interesting to know how it was done. There might be two or three explanations of the matter. One which suggested itself to his mind was this: Did Mr. Hill obtain more than 20 cwt. of coal to the ton? If so, it was not what they usually had in the North. Then in one place he spoke of the cost per 1000 cubic feet into the holder as being an average of about 1s; but at the present time, it was something like 1s. 6d. If he took the average over the whole of the years to which he referred, this was partly explained; but these costs now could scarcely be compared to the cost when they obtained 50s. per ton for tar, and half this amount for liquor. Were they to understand that the cost of 1s. per 1000 cubic feet into the holder referred to the whole average of the years named, or could it be done for this now? It seemed as if the extra 6d. accounted for the enrichment; but it did not correspond with the figures Mr. Hill gave as to the cost of enrichment.

Mr. J. W. Buckley (Falmouth) said the first thing that struck him was the paragraph in which Mr. Hill expressed the opinion that it was not necessary to have covered storeage. Most gas managers were taught that it was absolutely necessary to have their coal covered if they wanted the volatile matter that was in it when tested in the laboratory. Again, Mr. Hill was in the happy position of being able to take the coal direct from the waggons into the retorts. But very few managers were similarly placed; and even those who were on the coast had to bear the freight of coal for several weeks at sea, which added considerably to the expense. It was a pleasure to him to see the large amount of gas sold per ton of coal; but he should like to have a little further explanation. Mr. Hill spoke of 10,422 cubic feet of gas sold per ton of coal; but he (Mr. Buckley) should like to know if the bulk of coal carbonized during the year was deducted from the quantity received; and did it coincide with the amount in stock at the end of the twelve months. He believed many had noticed that, while men were credited with big makes of gas per ton, when they came to take stock in many cases they were hundreds of tons short. A slight deficiency in stock considerably interfered with the make or sale per ton. For instance, take works carbonizing 5000 tons per annum. If at the end of the year there was a deficiency of 100 tons, this worked out to about 2 per cent. on the make; and he should like to hear what Mr. Hill's experience was in this matter. While they noticed the coal in stock being short, it had also been his pleasure to observe of late one or two places where the coal had been in excess according to the books. The members were all, he was sure, obliged to Mr. Hill for the information he had given.

Mr. J. Stelfox (Belfast) said there were certain items in the paper which seemed to run in the same direction as his own; but there were a few things in the table which he did not understand. In the first place, with regard to the enrichment of gas. It was a very complicated question, because, if the figures he (Mr. Stelfox) had given to the meeting were taken, he could show that for some time past he had been enriching gas for less than nothing. For, if he mixed 500 cubic feet of 17-candle coal gas, costing him 6¼d. (13½d. per 1000 cubic feet) with 500 feet of 21-candle carburetted water gas, costing 6¼d. (12½d. per 1000 cubic feet), he had 1000 feet of 19-candle gas, which cost 13d., or ½d. less than 1000 cubic feet of the 17-candle gas. As to Mr. Hill's figures, it did not strike him (Mr. Stelfox) that it was a good system of enrichment which varied in the cost per candle as 1 : 43. If enrichment one year cost only $\frac{1}{33}$d. per candle, and the next year 1·4d. per candle, it seemed very extraordinary. Another thing appeared to be very remarkable—viz., that at a time when 82 per cent. of cannel and 18 per cent. of coal were used, the illuminating power of the gas was 19·73 candles. But in the year 1894, when there was 83½ per cent. of coal and only 16½ per cent. of cannel used, the illuminating power remained practically the same. It seemed as if it did not matter whether coal or cannel were used, as the results were the same. Another singular thing disclosed by the table was that, when 82 per cent. of the fuel employed was

cannel, the weight of coke produced was 70 per cent. of the weight of the coal used; whereas when 82½ per cent. of the fuel was coal, the produce of coke was only 60 per cent.

Mr. E. C. Riley (Swindon) said Mr. Hill had made a considerable point about the storeage of coal. With reference, however, to that which had stood four years in the open, he did not give the results when the coal was originally received, but simply those obtained after it had stood for that time. If he would furnish the results when the coal was first delivered from the colliery, the members would be in a better position to judge of the effects of atmospheric influence. As a previous speaker had just remarked, this was quite contrary to what they were generally told; and at the present time, when the tendency was for large stocks of coal to be put down, the question of storing in the open as against covered stores was very important. If no injury resulted from the storeage of coal in the open air, it would relieve the minds of many managers of the difficulty they were in from having large stocks of coal to meet cases of difficulty which might occur in the future. He did not know if this was a matter which referred specially to North Wales coal; but two or three years ago he had some hundred of tons of this coal which stood for about a year in stock. When it was used, he provided for a loss of 5 per cent. in consequence of this; but really, when the working was concluded, the loss was practically scarcely anything—certainly not more than 1 per cent. Whether or not this applied to North Wales coal only, he could not say.

Mr. C. Stafford Ellery (Bath) remarked that, although they might not agree with all Mr. Hill's calculations, they would appreciate the trouble he had taken in preparing his paper. He (Mr. Ellery) should be glad if he could give them the name of the coals, or the district from which they came, because a great deal depended upon this. The last speaker had referred to storing coal in the open. Mr. Hill seemed to think that covering coal was not necessary. This largely depended upon the class of coal. He (Mr. Ellery) imagined that some coal might be stored in the open air with practically little loss; but he doubted if a soft coal could be exposed for any length of time without depreciating very considerably. In addition to this, there would be a quantity of moisture absorbed; and, according to his experience, such coal could not be carbonized so satisfactorily as that stored under cover. But the point he rose to speak to was whether Mr. Hill could not at present purchase cannel at better prices than were paid some time ago, as a consequence of the quantity of oil now being used for enrichment. This must have affected the cannel market. He was told that those who had cannel to offer were now doing so on much better terms, on account of the smaller demand. Towards the end of the paper, there was a reference to the question of leakage. What this had to do with the use of cannel as an enricher, he had been striving in vain to understand.

Mr. T. O. Paterson (Birkenhead) said, though Mr. Hill seemed to have made a great point of enriching by cannel, he thought a better case could be made out by the use of oil for enrichment. If it were necessary to raise the quality of gas from 15½ to 19½ candles, or four candles, this could be done by the use of oil, in works producing 500 million cubic feet of gas a year, by manufacturing 30 million cubic feet of Peebles oil gas, at a cost of £4462 for oil at 3d. per gallon, which was a high price compared with some quotations which had been mentioned. Then there were the interest on the plant, royalty, wear and tear, and labour, which came out at £1040; making a total of £5502. But the cost, at the present time, of enriching 500 million cubic feet of gas by four candles, was £8625. This left a difference of £3123. Then there was also the residual coke from the oil process. So that, allowing for every expense, they could carburet with oil for a little above ½d. per candle per 1000 cubic feet; thus proving that, even at the current low price of cannel, it was cheaper to use oil.

Mr. Tim. Duxbury (Middleton) said he should like to know by what means the illuminating power of the gas had been obtained—whether by the bar or by the jet photometer. It appeared, from a paper read at a meeting of one of the District Associations a few months ago, that the illuminating power was ascertained by the jet photometer, and the results were better than those he could obtain. Using the same percentage of cannel, he did not find he could get more than 10,000 cubic feet of 18 to 18½ candle gas. But under his predecessor, who used the jet photometer, the illuminating power was published at 19 candles. When he obtained the bar, he found the jet was about 2 candles too high. He should therefore like to know by what photometer the test had been made.

Mr. Hill, in reply, said Mr. Lees had gone into a very interesting calculation as to the weights of the products and of the gas. He (Mr. Hill) had not had time to check the figures; but he could only say they must be wrong, because he knew his results were right. They were certainly within the truth. The question of overdrafts naturally cropped up; but he did not think any managers had them now as they used to do. There was a very small quantity—about 8 out of perhaps 1000 tons—but what there was was taken in. It was important to bear in mind, as Mr. Buckley had pointed out, how much difference even a comparatively small quantity of coal would cause in the make of gas per ton. If there were a difference of only 100 or 200 tons in 10,000 or 20,000 tons, it was perceptible. Then it was said that they could not compare present results with those obtained when tar was at a higher price. But he could not understand why they should not revert to the former condition of things. The general rule was that they had ups and downs and fluctuations in trade; and he did not see why they should not again get 50s. for their tar. The price of cannel was going down; and he did not give up hope that they might do as well as before. With regard to Mr. Buckley's question as to covered storeage and unloading seaborne coal, of course he (Mr. Hill) pointed out particularly that these matters must depend upon the circumstances of each different works. The gas sold was 10,495 cubic feet per ton; and this figure was arrived at by carefully allowing for the stock at the beginning and at the end of the year. They had only charged against the make of the year the quantity of coal actually used. He did not quite follow all Mr. Stelfox's questions with regard to enrichment. Of course, it was a strong point where one was liable to an outlay for enrichment, which might vary from 0·032d. to 1·5d. per candle per 1000 cubic feet. It would make a serious difference; and this would have to be dealt with in the future. If they employed oil in large quantities, and if it fluctuated in price like cannel, they would be liable to similar variations. With regard to the quantity of coke produced, this only showed what differences there were in quality. There was cannel and cannel, and coal and coal. They used in recent years a regenerator furnace, which would partly account for the result. As a matter of fact, at that time they were enriching for less than nothing, because the cannel cost less than the coal, and it gave the coke as stated. Mr. Riley had referred to the storeage of coal in the open air. He (Mr. Hill) purposely omitted giving the results obtained from the coal when first received, as it was a mixture with cannel. They did not carbonize the coal by itself; and therefore he could not very well give the figures. He simply asked the members to accept the statement that there was a decided improvement in the quality of the gas when that coal was being used; showing that the depreciation was practically nothing. With regard to covering or not covering the coal, he especially pointed out that, whereas the late Dr. Wallace with some coal lost 50 per cent., his experience was that with the coal he had employed he had not lost anything; and therefore he did not think it worth the expense of putting up covered stores. It so happened that the sample of coal was from North Wales; but he did not use this exclusively. He also had North Staffordshire and Wigan coal, the same as was carbonized in a large number of gas-works. Mr. Ellery had asked him to name the coal; but he thought what he had said would probably be sufficient. They used the cheapest coal offered to them from those districts up to the present. It was screened; but he was strongly inclined to go in for unscreened coal. Mr. Ellery was quite right in drawing attention to the cannel market. There was no doubt the introduction of enriching processes by oil had had a marked effect on cannel. The same gentleman said that he did not understand the reference made in the paper to leakage; and he (Mr. Hill) might admit that it was a little disconnected from his subject. But he had simply given the results of twelve months' observation on this point; thinking it would be of interest. Mr. Paterson was very much in favour of oil in place of cannel. Of course, he (Mr. Hill) could not expect everybody to agree with him. He did

not pin himself to cannel; he only stated what he had been able to accomplish with it. If much better results could be obtained with oil, he should go in for it. With regard to testing the illuminating power, they were thoroughly fitted up with appliances and had a good staff, who had charge of the water-works as well as the gas department. They had a qualified chemist to look after that department; and they had regular testings by the jet, which was repeatedly standardized by the bar photometer. The jet photometer registered half a candle below the bar; so that these figures were registered on the low side. He might say that he had the duty for six years of testing the gas for the Corporation of Liverpool; and so he had had some experience in the matter. He knew there was a lot of scepticism with regard to the illuminating power; but in this case they were fully equipped with appliances, and had specially qualified men to use them.

Discussion on Mr. C. Stafford Ellery's Paper on "The Application of Coal Tar for Making Gas."

Mr. Tim. Duxbury (Middleton) asked if the gas made from tar was permanent; also if Mr. Ellery found any pitch or deposit to any great extent in the foul main or ascension-pipe. He was rather at a loss to know why Mr. Ellery should refer particularly to the process mentioned in one paragraph in his paper. They had a process—the Dinsmore—working at Widnes some five years ago; and it was working practically now, and giving good results, The paper did not seem to furnish any figures from which comparisons could be drawn. The process seemed to be very much in an experimental stage; whereas the Dinsmore process had been in operation for five years, and working on a practical scale.

Mr. Isaac Carr (Widnes) remarked that, whatever was thought about the contents of the paper, the members would all agree in admiring the courage of any man who would champion such a subject as the one before them. He had begun to think it was dead—having come into violent collision with many high authorities when he (Mr. Carr) took up the matter some years ago. But he was very pleased and interested to find there was a revival. Of course, he had read Mr. Ellery's paper carefully before the meeting; and the results the author had obtained were very good, and afforded a much more remunerative means of utilizing tar than selling it or even distilling it in the ordinary way. Those results were peculiar, he should say, to the treatment, which was somewhat different to his own method at Widnes. He should like to mention that tar from ordinary Durham and Northumberland coal, which was the worst tar-yielding coal in the country, was capable of being made to give a much higher illuminating power than 15 candles. In their tar-carburetting apparatus, they obtained from Lancashire coal regularly 21 candles; but, of course, there were differences in the method of treatment. He was obliged to Mr. Duxbury for pointing out to the meeting that he (Mr. Carr) had done something in connection with this subject. This reminded him of a paragraph in the paper in which it was said that little seemed to have been effected beyond the experimental stage. The members would forgive him if he claimed to have passed a little beyond the experimental stage, seeing that he had had a whole retort-house working for five years solely for carburetting with tar. The great difficulty with the tar process had been the want of competition and the preconceived prejudices on the part of gentlemen who had not succeeded with it. They considered it a failure; and, of course, if a man of importance tried a thing and failed with it, nothing more need be said. The fault was with the process, not with the man. This had been the case with the tar-carburetting process, as far as it had gone. Not many weeks ago, he had it from a gentleman of high standing in the tar world that the carburetting of gas by introducing tar was wrong in theory; and, of course, what was wrong in theory must be practically impossible. Notwithstanding that, he kept going on supplying his consumers with tar-carburetted gas; and the evidence he had to offer was the £ *s. d.* one at the end of the year. From a commercial point of view, their figures would compare favourably with those of any other gas-works in the country. Of course, the value of the tar carburetting system at Widnes was not so much in the extra quantity of gas made as in the quality. They did not buy any cannel—they used nothing but common slack; and then supplied gas of 18 to 19 candle power, and put it into the holder at about 10d. per 1000 cubic feet. On this head, as Mr. Hill had properly pointed out, it was difficult to make a comparison on such figures until all the points were understood. They might be getting a bigger return for their residuals, which would keep down the total cost into the holder. But, as a matter of fact, the price for residuals was pretty much an average in the district; so that this figure might be taken as a fairly comparative one. One of the difficulties which he (Mr. Carr) had to encounter when he started out, full of enthusiasm, with this method, was that antiquated specific gravity table up to which Mr. Valon and others said the results obtained at Widnes should measure. It was supposed at that time that a gas giving a certain light must be of a certain weight. Out of the thousands of coal analyses, there were not two alike; and it occurred to him that, with all these variations, there must be similar variations in the composition of the gas. Subsequent investigation proved that this was so, and that there was absolutely no reliance to be placed on the assumption that the illuminating power of gases bore a specific and definite relation to their own specific gravities. When it was considered that in tar-carburetted gas they had a little increase of acetylene—the highest light-giving compound yet discovered—it could be readily understood why they could get an enormous increase in the illuminating power without a corresponding increase in the specific gravity. He pointed out all these things at the time; but they seemed to have been forgotten or lost sight of. However, he still kept pegging away, much to the surprise of certain of his friends, some of whom sometimes said to him: "Are you working that process yet?" and when he replied in the affirmative, they seemed quite astonished. His own opinion was that, if they could only get some men to work at it who had had no previous experience in tar-carburetting, who started with no preconceived ideas and blinded prejudice, then there would be good hope for the future; and they would give up paying from 3d. to 6d. a gallon for oil to enrich their gas, and, on the other hand, sell for ½d. a gallon tar, which, if properly applied, would give almost as good results.

Mr. D. Vass (Portobello) said he made some experiments with tar about nine months ago. He pumped tar from the well into an overhead tank, and ran it into the retorts. At first, the pipe being rather too small (about ¾-inch), they were troubled with a deposit of soot in the ascension-pipe; but when he increased the diameter of the pipe to 2 inches for the greater part of the way, finishing up with short pieces of 1 inch, there was no difficulty in getting a good flow, and they had the coke well formed in the retort. It ran about half an hour, and then it was burnt off or carbonized for three hours before taking off the lid and drawing the charge. The gas, therefore, was making for 3½ hours. By some mistake, on one occasion the lid was opened an hour after the tar had been run in; and the whole mass came out in a liquid form. This was why he would ask Mr. Ellery if the charge of tar was run in all at once, and allowed to carbonize. The production of coke was pretty large; but he had not had sufficient experience with it to be able to state the quantity definitely. They discontinued the process because they could not get for the ammoniacal liquor a price sufficient to induce them to go in entirely for distilling tar and selling the liquor separately, so that they were forced back to the old position of selling the two combined.

Mr. W. Carr (Stalybridge) said, before the discussion closed, he should like to acknowledge how much he was indebted to Mr. Ellery for having introduced the subject before the meeting. It was a laudable attempt to do something with tar; and he was very much surprised to find that it was accepted so quietly, though evidently with some degree of scepticism, by the meeting. During his leisure time, he had had the opportunity of going to Widnes on several occasions and seeing the work done there; and he could vouch for the truth of what his brother had stated. During the last two years, notwithstanding the serious loss by the coal strike, they continued to sell gas at a price below 1s. 7d. per 1000 cubic feet taking it all round, and pay their expenses, and cover all their losses. This was not a very common experience in South Lancashire; and there must be some virtue in a process that enabled them to achieve such results. It was a matter worthy of some careful attention on the part of all those who were interested in the question of cheap

gas, because, as Mr. Newbigging had remarked on the previous day, in these times everything resolved itself into the production of cheap gas. Here was a process which had enabled the Widnes Corporation to sell gas at the price he had stated. It had been going on for several years; and this rather took it out of the experimental stage. It had been a dream of a great many gas makers to do something with tar; many had tried, and many had failed. He remembered the time when Mr. Malam, of Dumfries, had a process which was much talked about at the time, and which was only an attempt to utilize the tar fumes before they got into the hydraulic main. He charged one half of a through retort at once, and let the gas pass over the hot coke in the other half. Gentlemen conversant with gas manufacture at that time would remember the process. Mr. Malam said he obtained excellent results; and he (Mr. Carr) believed it. He found difficulties in the shape of choked ascension-pipes, and other objections to the working, which led to its abandonment; but the fact still remained that these results were obtained, notwithstanding, as in the case of Widnes, where the difficulties had been very great, that it was a troublesome process to manipulate. Nevertheless, if these difficulties could be overcome, it was well worth serious consideration. If he had been in Mr. Stelfox's place, under the circumstances he had described, he should probably have done as he did; but it seemed very remarkable to him that eminent engineers should be going in for enriching with oil, when they had at command a material which they did not know what to do with, out of which they might get the effect they went to America or to Russia to obtain. It would be wise, therefore, if this matter were more fully ventilated. He was not himself in a position to experiment upon it or to test it; but there were many others who were. He was quite sure every gas engineer was willing and anxious to adopt the best method of gas manufacture. It was said, he believed, that the statements made with regard to the working at Widnes were untrue. A gas manager said to him some time ago: "The fact of the matter is, we do not believe your brother does what he says he does." He (Mr. Carr) knew that he did, because he had been there and seen it for himself; and anyone who wanted to investigate the matter could, no doubt, have an opportunity of doing so. At the same time, he did not think his brother had accomplished all that could be done with tar. He, therefore, welcomed the paper before them, because it was a step in the right direction. They had a most valuable bituminous product which ought to be utilized. It was their duty to investigate the subject, and not to sell their tar at a frivolous price, but make use of it themselves.

Mr. C. A. Craven (Dewsbury) said gas undertakings were not getting the price for tar they ought to have. The figures Mr. Ellery had given proved this. Out of a ton of tar, there was 60 per cent. of pitch, which would represent, at present prices, the whole money he could get for tar—15s. or 16s. In addition to this, he should put down another 1s. for ammoniacal liquor; so that he obtained from the two products alone as much money as he paid for the tar. The tar distillers received all the rest of the products; and they could afford to give more than they did. He had felt for some time past that gas companies were not receiving the value of their tar products from the purchaser.

Mr. T. Duxbury (Darwen) said he had had some little experience in this matter; and he was only sorry he was not in a position to bring the results forward in a paper, as he had almost promised to do at the meeting in Belfast last year. He was still going on with it; but he had had some drawbacks, which had precluded him from laying full information before the members yet. He might say, however, with respect to what Mr. William Carr had stated, that he was himself somewhat sceptical as to what Mr. Isaac Carr said he had been able to accomplish. He (Mr. Duxbury) was unable to get the results now obtained by Mr. Carr; still he was realizing considerable results at Darwen. He had been working for eighteen months with the present plant. Last year he had only been working six months. During the year ended in March last, his make of gas had been 500 cubic feet more per ton of coal, using about a gallon of tar per ton; and it was 0·61 candle better in illuminating power. This was taking the average of the whole year, and with only one-third of the plant on the Dinsmore system. He was not aware what Mr. Carr was getting; but it was something in advance of that. Still he had taken some tar off the market; and he intended pursuing the matter further. He was very pleased Mr. Ellery had taken up the subject; and he hoped they would have further information from him upon it later on.

The President said the members were much indebted to Mr. Ellery for having brought forward his paper, and especially as he was asked at the eleventh hour to prepare it, as it was felt to be an important subject. He thought Mr. Isaac Carr should not take the matter quite so much to heart as he had done. He (the President) had heard a great deal about the process Mr. Carr had been working at for some years; and he could assure him that most of the scientific men who went to Widnes to investigate the subject—men like the late Mr. Foster, Mr. Newbigging, and Mr. Watson Smith—told them there was something in it, and that it only wanted working at. Of course, it required money and time for such gentlemen to work at it; and therefore they left it in Mr. Carr's hands to go on with. He had repeatedly said to friends who had asked him about it, that there was something in it—that it only wanted time to work it out. He did not think he had heard people say they did not believe in it; but they had a right to be a little sceptical until the process was proved a success. He had seen the accounts year after year, and had been surprised to find how Mr. Carr had been quietly backing up his statements by commercial facts. He was now making gas at a very cheap rate; and he had done a great deal more than many of them expected.

Mr. Ellery, in reply, said it appeared to him that the subject before them, although well worn, was of pressing importance. They all had on their works a material capable of making gas, which ought to be more profitably utilized. The figures he had given were well on the safe side; but they paid carriage to send this material away, and paid to bring back another to do the very same work. He claimed that, in the present condition of the tar market, they were not altogether wise in not helping themselves to much better figures. He should like to have heard something more against it in the way of criticism, which would probably have put the thing in a better light before the meeting. Unfortunately, there was not time to fully discuss the papers that were brought forward. Mr. Hepworth had put into his hand a note: "How would it affect the price of gas if we converted all our tar into gas?" That was a practical question. He admitted with the President that there might have been more figures; but he had given quite enough to answer that question. If 1 ton of tar produced 16,000 cubic feet of gas, 1 cwt. would produce 800 cubic feet, and, therefore, if they used all the tar, the make of gas per ton of coal would be increased by 800 cubic feet. Putting it into money, and basing his calculation on the figures given in the paper, it ought to mean, at the works he represented, that, if they used the whole of the tar, the income would be increased by something like £600 or £700 per annum, which he thought was no mean thing. The result should be, if tar were thus used more generally, to make its price still better. As to pitch being deposited, he might say at once that this largely depended on how the tar was used. If it was put into a retort at a very high temperature, and free carbon produced, it was very troublesome, and choked the pipes. He thought it was free carbon passing up the pipe, and mixing with the oils, producing a mass which appeared very much like pitch; but he believed it was really a mechanical mixture of the light oils and the free carbon given off from the decomposition of the gases or vapours produced in the retort. He was sorry it should be thought that he looked with indifference or disrespect on any other process for making tar gas. He could assure the meeting that it was the farthest thing from his mind. At the previous meeting, in Belfast, he referred to the Dinsmore process; and he appreciated any process which had for its object the utilizing profitably of tar made in gas-works. He did not refer to it on the present occasion, as he was striking out in a somewhat new line in the way of producing gas from tar. As to its being wrong in theory, it all depended on who the man was who produced the theory. A great many theories had been proved wrong; but, after some years of patient—and he must say dirty—work, he was there to declare positively that, whatever theory might say, in practice it was possible to produce the returns he had stated. If nothing else had been achieved, he was glad to have drawn from

Mr. Carr the fact that he was still using tar. He wished he was using all his tar. If there were no other result, he trusted that others would take up the question and experiment, especially in small works which could not readily dispose of their tar; and he was satisfied they would increase their returns, and, by taking some tar off the market, improve present quotations. He had especially inquired as to the permanence of the gas. It had been stored in a special holder; and he took the extra precaution to have the manlid in the crown lifted, to see if there were any oils deposited. There was nothing found in the syphons or gasholder. He had every reason to believe that the gas he made was permanent.

PAPERS READ AT THE MEETING.

GASEOUS FUEL.

By T. Travers, of Cork.

The question of gaseous fuel is receiving a good deal of attention—not more, nay, not even as much as its importance merits, whether regarded from a domestic or manufacturing point of view, for, by reason of its sanitary and economic advantages, it is destined to be the fuel of the future. Sanitary science has of late been largely directed towards the solution of the smoke abatement question; and every step in this direction must benefit our thickly populated towns. Take, for example, the Metropolis, where the annual consumption of coal is about 9,000,000 tons, which, when consumed as solid fuel, discharge into the atmosphere hundreds of thousands of tons of impurities, injurious alike to animal and vegetable life, and from which arise those fogs which contain all the elements of matter, both liquids, gases, and solids. A fuel which would deliver us from such ills would be a desideratum. Further, the increasing demand on our coal-fields (the sheet anchor of this country's greatness) becomes a serious matter; for it must be remembered that, for the last 60 years—that is, since 1834—the consumption of coal has increased tenfold as compared with the advance made for the six centuries previous. Thus we are eating into our resources, and living out of capital instead of revenue; the consumption being at the rate of 5 acres 2 feet thick every hour day and night. No reproduction is taking place, for coal is no longer forming; and, besides, the difficulties of winning it are increasing. The Royal Commission which some time ago inquired into the matter (though some of their conclusions were not satisfactory) called attention to the fact that we must look to science to learn how best to care for these invaluable treasures.

The steps which we have been taking to introduce gaseous fuel for domestic purposes, are a contribution to this important work which is not sufficiently appreciated. Take a ton of coal and use it in the good old way—that is, whenever you require a fire in your parlour or office, you have, so to say, to manufacture it there, in the same primitive fashion that it was done centuries ago, at the expense of damage more or less to your furniture, &c. But more important still is the waste of thermal power at the top of every chimney where the coal is thus consumed, even with the best appliances—a loss proved to represent 75 per cent. of the heat-giving efficiency of the coal, and carrying with it other valuable constituents. Now let us treat the ton of coal according to our ideas—that is, carbonize it, with the result, you are aware, that we get gas for lighting and heating that will serve a moderate sized family for some months. Then we have the coke, which is capable of giving nearly as much heat as the original coal from which it was produced, and also other valuable residuals. As a further step in the way of economy, we can, by gasifying the coke, produce a fuel for the retorts which is particularly suitable to our industry, and which has also been found to be advantageous to other manufactures of an extensive character—effecting a saving in fuel ranging from 30 to 70 per cent., which must go a great way in husbanding our resources.

Although, generally speaking, gaseous fuel is now to be found in operation in every well constructed gas-works, yet other manufacturers forestalled us in the introduction of it. When the subject was brought forward for the first time for discussion at our meeting, I remember the then President remarking that it was a novel question to bring before the Institute—indeed, it was not until it came to us with the hall-mark "Made in Germany," that we thought of taking it up. It was on the occasion referred to, that we were favoured by the presence of one whose name will live in the annals of the century, for, by the application of his great genius to the Arts and Manufactures, it can be truly said he left the world better than he found it. I refer to the late Sir William Siemens. It has been admitted that to him is due the credit of having first applied gaseous fuel to our retorts.

It may now appear that the process is very simple by which coke is gasified to carbonic oxide, and the waste heat recuperated in order to raise the temperature of the air for combustion; yet it required much thought and patient experiment to render its application practicable. Doubtless the first installations, owing to their complication and expense, were not calculated to encourage the adoption of the system in any but works of the first magnitude—at least, this was the impression left on the minds of many of us who saw at Paris years ago the regenerator with which Sir William Siemens's name was first associated, the reversing surface regenerator. At the time, it was regarded as the most perfect method of obtaining high temperatures, and great economy at low temperatures. Expensive as was the plant at the Paris Gas-Works, we were assured that the saving of fuel amply compensated the Company for the outlay, and that the patentee realized a handsome royalty. However, it was apparent that, before gas-works generally would avail themselves of the principle, the system should be simplified, and be automatic in its operation. Consequent on the attention given to the subject, we have now many adaptations of the principle (all bearing a strong family likeness), suited to every variety of circumstance, and designed to overcome obstacles previously considered insuperable.

In Cork there were many difficulties to contend with in adopting gaseous firing. Working under the old system, we had on an average realized from residuals over 70 per cent. of the cost of the coal. In this there is not much to complain of; but where better is possible, it is not the spirit of the age to be satisfied. In our case, the earlier forms of regenerators were out of the question, requiring as they did excavating to a depth of 8 feet or so. With us this was impossible, owing to the proximity of water; our city being built on islands, and our principal thoroughfares being formed by arching over rivers. This accounts for the fact that a Cork man, when at home, is always certain to be able to "keep his head above water." Another difficulty was that the site of the works had been literally scooped out of a rock, the boundaries being in some places 30 feet high; and the rock was of a very cross-grained character.

In order to overcome the above difficulties, we tried some years ago a system of gaseous firing; and although it did not prove to be as successful as we had expected, I deem it not inappropriate to describe it, for partial failures often lead to important suggestions, particularly in an Institute like this, comprising men of such extensive practical experience. The experiment which we made was with what is generally known as producer gas; and for this purpose we erected one of Wilson's gas-producers in duplicate. This is a sort of cupola furnace, contained in a cylindrical iron case. It varies in diameter according to its capacity for work; and is usually constructed about 10 feet high. The bottom forms a solid hearth, without any grate-bars, on which the fuel rests in a mass 6 to 8 feet in depth. There is a box situated on the hearth, having openings in its sides, through which are forced air and steam for decomposing the fuel. The clinker, and incombustible residue are removed through doors at the bottom. The upper portion is furnished with openings, through which the gases are led off; and at the top is an arrangement for charging, consisting of a bell and hopper, with slide to prevent the escape of gas whilst doing so. The interior being nearly full of coke, breeze, or small coal, air and steam are injected into the centre of the fuel from each side of the central tuyere-pipe, which communicates with the steam-jet blowers outside. Rapid combustion takes place, resulting in the formation of carbonic oxide and hydrogen, which, passing upwards, escape into the annular flues surrounding the upper portion of the chamber, from which they pass through the down pipe to the furnaces of the retorts to be heated. The whole of the fuel except the ash was transformed into gas, of which an analysis gave the percentage in volume as 39·9 per cent. of combustible gas.

In connection with the gas-producer, there was also erected a regenerating arrangement, consisting of two chambers on the top of the benches and close to the chimney. Within these chambers were a series of cast-iron pipes. The waste heat from the main flues was made to pass around the pipes; and the air for combustion was forced through them by a blower or fan, in order to transfer the heat rapidly. Iron pipes exposed to waste gases, so as to heat the air passed through them, will stand for years, if the air be so supplied as to ensure a constant current and consequent uniform withdrawal of heat from the pipes. The heated air was conveyed to the furnaces; and there, with an arrangement on the blow-pipe principle, it met the producer gas for combustion. We were encouraged to look for success in the trial by the results obtained by this system in smelting steel, &c., and also because it would be a means of converting breeze, which is a drug to many, into a valuable fuel.

Five settings of retorts, with eight in each oven, were heated in this way; and in order to make the test complete, we had back to back with these a similar number of retorts fired in the ordinary way. We got the gas-fired retorts to an average heat capable of carbonizing each about 9 cwt. of coals in the 24 hours; and we sent all the coke produced from the coal into the yard for sale. We found, however, that the cost by which those results were attained did not compare favourably with the old system. Were we to go over the same ground again with the experience we have had, the following alterations would, I think, tend to bring the system within measurable distance of our requirements.

(1) The labour was a large item; a good deal of it being caused by having to stop and clean out the producers every 24 hours. Since we made the trial, an automatic discharger has been invented by Mr. Wilson, by which the solid matter is made to sink through water, and is then forced out by worms up an inclined plane. In this way, clinkers of many inches cube can be sent out; and when too large they are crushed—the water preventing any gas from escaping. If the power which is used for discharging the producers could be also applied to charging them, the point would have been met.

(2) In erecting the producers, they were placed in a house apart from the retort-house which they were intended to heat; the result being that a good deal of condensation took place between the "down come" and the point of combustion. By having the producer as close to the retorts as possible, the gas would be delivered at a much higher temperature, and consequently with increased efficiency.

(3) Instead of applying the system to retorts set on the usual plan for solid fuel, suitable combustion chambers for the more uniform distribution of the gas would, I think, economize it.

The matter, I submit, has a special interest for gas companies, offering as it does the prospect of utilizing the least saleable of our residuals.

An opportunity was recently afforded of making another trial of gaseous firing. Having to reconstruct some old retort-ovens, it was thought that it would be well to see if any of the existing plans would meet our case. Many were inquired about; but our old enemy water was apparently making the position impregnable. Fortunately we heard that in two or three works in the North of Ireland, there was in operation a suitable system. The advantages claimed for it were that it could be made to effect a considerable saving under adverse circumstances—such as natural difficulties, shallow drainage, height of roof, &c.—and that it could be adapted to either large or small works, even to settings of two retorts. The use of all unnecessary ramifications of flues is avoided; and especially is this worthy of consideration where they are obtained at the expense of excavation. The system I refer to is that known as Hislop's, the patentee of which is the well-known Engineer of the Paisley Gas-Works, Mr. G. R. Hislop.

As the difficulties, both natural and artificial, which Mr. Hislop proposed to overcome existed at the Cork Gas-Works, the Directors decided to afford him the opportunity of doing so. We had water sometimes as high as our ash-pits. The rock on which the bed of the old ovens rested was nearly as hard to chisel as chilled iron—being largely composed as it was of silica; and the roof, a legacy since the time when gas was first made in Cork, in the year 1822, was very low. The necessary drawings were obtained from Mr. Hislop; and the copies of them here so fully illustrate the system, that a very brief description is all that is necessary.*

The producer is included in the settings, and does not extend beyond the mouthpiece line; thus leaving a clear way for coke-barrows, &c. The special feature of the producer is that it offers increased facilities for the removal of clinker, &c. It is oblong in shape; and the floor is formed of slopes or half arches springing from a central block. The spaces under the slopes are provided with ash-pans, for receiving clinker, &c. These are supplied with water, which is evaporated by heat from the waste gases, so arranged as to be made to pass under the protecting tile on which the pans rest. The regenerators are on either side of the producers. They are constructed of special fire-tiles, which are so arranged that the waste gases from the ovens pass down the opposite direction of the secondary air, and thus the two are made to traverse several times the length of the retorts. From the side of the regenerator, and over the pans, is thrown a curved plate, having ports for the admission of air and steam to the producer. The air to the producer is regulated by air-tight doors, having moveable discs inserted in the cast-iron frame which forms the front of the producer. In this frame are also two air-tight doors, one above the floor of the retort-house, and the other below in the sunk chamber. The upper door is for charging the producer; and the lower door is for clearing it out.

For feeding the producer with hot coke direct from the retorts, there is a very complete arrangement consisting of a moveable funnel, so arranged that the coke from the two centre retorts falls by gravitation into the producer. Not only is this much easier for the men (being automatic in its operation), but it adds much to the efficiency of the fuel, as the time of charging the producer is much shorter, and the coke is not cooled in any way, as was previously the case, when the man had to draw the coke into a barrow, and then with a shovel charge the furnace. When the funnel is not required, it falls back out of the way, and an air-tight door closes the opening by which the coke has been delivered.

The secondary air supply is regulated in the same way as the primary air—by a sliding disc; and the waste gases are regulated by a horizontal damper just before their exit to the main flue. The combustion chambers are right over the producer, with ports so arranged that the combustion is perfect along the whole of the setting. The sunk chambers are about 4 feet deep, and extend to about 8 feet in front of the bench. They are covered with suitable doors, which form a good charging-floor for the stokers. When all is complete, it forms a very compact job.

The arrangement with Mr. Hislop was for the erection of eight benches of eight retorts in each. The Company did all the excavation, formed the main flue under the ovens, built the oven arches, and provided and erected hydraulic mains, ascension-pipes, and mouthpieces. Mr. Hislop's portion of the work was to build the producers, set the retorts, and provide all special castings—such as the producer fronts, doors, floor-plates, &c. The cost of the entire labour and materials was a little over £1900—say, £30 per mouthpiece. It would have been fully £2 per mouthpiece less, had it not been for the cost of cutting away the rock, and laying pipes, sinking a well, and erecting a steam-pump to draw off the water. We have to continue to use this steam-pump; but the water is useful for the works.

In consequence of the roof being low, we had to lower the hydraulic main, and to make other alterations; and even after doing so, the arch-pipes are as high as the tie-rods of the roof, giving the men very little headway to clean them when necessary. In order to gain depth, we had to do away with having the water-pans heated by the waste gases, using steam from the boilers instead. However, when the work was heated up, there was no undue shrinkage or settlement of any kind; and the retorts showed a perfectly uniform heat from front to back. When we commenced charging, we found the heats were inconveniently high, as a result of which we were much troubled with choked pipes, and the tar in the hydraulic main became all but pitch. We tried steam injecting

* Illustrations of Mr. Hislop's retort-settings were given in the JOURNAL for May 9, 1893 (pp. 824-5), in connection with the paper prepared by Mr Er W. Smith for the North of England Association.—ED. J. G. L.

into the main, and this gave temporary relief; but what we found to be still more effectual was mixing tar taken from the condenser tank of another retort-house with the thick tar. This had the effect of dissolving the latter, although it was almost solid. We also made an arrangement for drawing the tar off from the bottom of the main, with a suitable contrivance for regulating the seal.

We at first altered our system from scoop charging to shovel charging, as is the practice in Scotland; but we found that it was not easy to get the men to send home to the bottom of the retorts the small Durham coal which we use. As a result, the coal was too much to the front; and the slackness of it at the back increased the tendency to stopped pipes. We therefore reverted to scoop charging, with more satisfactory working.

As to the improved returns, in view of the fact that we have only been a few weeks at work with the system, it is too soon to give statistics on all the points; but I am able to give one or two, which will show that they are of a satisfactory character. I will premise by remarking that, while a high yield per ton and per mouthpiece is very desirable, yet under certain circumstances a moderate yield will be found to produce gas of a good illuminating power at a less cost. I am aware that over 9000 cubic feet per mouthpiece, and between 10,000 and 11,000 feet per ton may be obtained. I have no doubt but we could do the same; yet, for reasons which I will give, it would not with us lead to increased economy.

The coal which we can obtain on the most favourable terms is unscreened Newcastle; and from this we get, without cannel, about 9500 feet of 16-candle gas. Now, when I take in our case the cost of coal, less residuals, and compare it with the cost of the coal, less residuals, in the works where the higher yield per ton and mouthpiece is obtained, I find that it gives 2½d. per 1000 cubic feet in favour of the former. One thing is certain, and that is that we are now making more gas with half the number of retorts that we had in operation at the corresponding time last year; and with a favourable market for coke, it is of importance to us to obtain the best results in this respect.

I will show you how far we have improved in this matter in £ *s. d.*; for directors, as the guardians of the capital of the shareholders, naturally regard the financial question as of the first importance. Our clearly ascertained weekly coke sales show a gain of £25; and with the outlay of £1900 yielding a saving of £25 per week, it is easy to see that a little over eighteen months will clear off the entire expenditure. There is also a saving in wear and tear and labour, the extent of which I cannot give at present.

In conclusion, although we were at first slow as a body in taking up this question of gaseous fuel, we can now look back with satisfaction at the progress that has been made within the last decade. No longer are the advantages of it confined to large or medium sized works, but the smallest can share in them, as I have seen in practical operation. We have therefore here a case where the greatest good is done to the greatest number; and this is what we need at the present time, when we are engaged in such active competition. Even with the measure of success which we have attained, higher results are still possible; and we are reminded of this by our friend Mr. Edison, who has said recently that he considers it possible to get as much energy from 250 tons of coal as is now produced from 3000 tons—in fact, the matter is engaging his attention. When he has solved the problem, the Duke of Argyll may with perfect confidence extend the time of the adjournment of the Royal Commission on our coal resources by two or three centuries.

GASEOUS FUEL IN THE RETORT-HOUSE.*

By T. S. Cleminshaw, of Launceston, Tasmania.

There must be few indeed amongst those connected with gas engineering, who will attempt to deny that the retort-house claims their chief attention; for neglect of this important part of an engineer's charge cannot be made good in the subsequent operations. Relying therefore upon this axiom, and at the same time desiring to add to the large stock of literature on this by no means exhausted topic, must be the excuse for offering the results of years of research. It is not claimed that perfection has been reached in what is now brought forward; but it is hoped that, in recounting these experiences, others may be stimulated to improvements, and may profit by good results, as well as learn to avoid mistakes. If such is the outcome, the object of this paper will be achieved.

When entering upon my duties as Engineer of this Company, there was a retort-house at work containing a stack of eleven beds of three cast-iron retorts, 22 inches by 14 inches inside measurement, and 8 ft. 6 in. long; and it soon became evident, in the face of a heavy growth of consumption of gas, that efforts must be at once made to improve matters. The winter having passed, part of the stack was pulled down bare to the foundations; new centres were made; and a fresh stack built to accommodate ten beds of sixes, 22 inches by 14 inches inside measurement, and 9 feet long, with clay instead of iron retorts. Eleven years ago, regenerative firing was scarcely well enough developed to encourage the adoption of that system; nor did the length of time permit of such extensive alterations. The nature of the ground, from information received, was declared to be such as would preclude any chance of success in sinking ten or twelve feet, as the retort-house was within 100 yards of a tidal river, and the ground was black mud, very unsafe and treacherous. Subsequent excavations about the works brought about the determination to sink through this; and it was found that, though soft and very treacherous (unless well timbered), a good clay foundation was obtained. But, as if the risk of excavation was not enough, a wall, 23 feet high and 1 ft. 10½ in. thick, on a rubble foundation, had to be negotiated; and this wall formed the support of the retort-house and coal-store roof. The foundation of the wall reached 6 feet below the floor; and at a distance of 6 feet away from this wall, inside the retort-house, a heavy retaining wall was put in, 12 feet deep and 4 ft. 6 in. thick at base, tapering to 2 ft. 3 in. at top, faced with 9-inch brick in cement, and backed with cement concrete 9 to 1, composed of old bricks, retorts, clinkers, and sand. The foundation of this wall communicates with a permanent sump; and a small pump keeps the foundations drained—there being pipes laid in the foundations of the wall, to lead the water away. Cross walls 14 inches thick (provided with arches for facility of communication), of brick and cement, were placed from this retaining wall to correspond with the division walls of the benches, which were underpinned. The floor of the retort-house was laid on the cross walls, and consisted of corrugated steel plates, levelled up with concrete, to receive the brick-on-edge floor. The floor of the vault was concreted; and a gutter, to carry off any water, was led to a pit, which is cleaned out, as required, by a steam-ejector.

Outside generators were placed *in situ*, 9 inches away from the front of the bench; and the gas-duct to the setting was laid upon iron supports across the distance between the setting and the generator. A 5-inch thick tile was laid on the irons, covered again by a course of fire-bricks; 9-inch walls were added; and the cover was another 5-inch tile. [This tile later on fell in, and was satisfactorily replaced by arch bricks.] The gas-duct was 14 inches by 14 inches inside, and traversed the setting 7 feet; being provided with four silica nostril blocks, in halves, each nostril being 9 inches by 2½ inches at the floor level. The secondary air combined with the primary at a level of 5 inches below the floor, after having been heated in a portion of the brickwork on either side of the gas-duct; and four flues 10 inches by 6½ inches were formed, through which the air travelled about 25 feet. This system, though affording much improvement on the old style of furnace, is not deemed complete; but it gave such good yields, and effected such economy, that now two more benches are being constructed, one of which will allow of the waste gases heating both the primary and the secondary air.

It has been considered, in the interests of economy, most desirable to alter the old house, instead of building a new one at an outlay of well-nigh £15,000; and the use of gaseous fuel has fully justified the alterations, which have not yet cost one-tenth of the expense of a new house. Some idea may be formed of the saving effected, when it is recorded that 8500 cubic feet formed the extent of one man's labour at iron retorts per shift; 16,000 feet, with clays; 22,000 feet, and even more, with gaseous firing.

The oven is 7 ft. 1 in. wide, 9 ft. 3 in. long, and 7 ft. 9 in. high, to inside the semicircular arch. The sides of the oven receive a 4½-inch wall 4 courses high, 2½-inch bricks;

* This paper was taken as read, from want of time.

a midfeather wall, under the centre of the retorts, from the back of the setting to within 9 inches of the front wall; and a 14-inch furnace-wall (9 inches of the front part detachable for repairs), from the inside of the front wall to within 13 inches of the usual 4½-inch back wall. The two 14-inch furnace walls are joined across the back end, and form the "back chamber." On these walls, the bottom retorts are set, *with the flanges close to the side of the oven;* and the bodies are packed with broken bricks and fire-clay, so as to make them solid. Three 9-inch furnace arches, of best silicon bricks, are turned off the bottom retorts, and levelled up across to form the bed for the middle retorts; the 4½-inch back wall, and 9-inch wall of the back chamber being similarly treated.

The middle retorts are now run in, bedded, blocked at bottom with feather-edges, and set 3 inches away from the side of the oven to the body of the retort; and stays are placed from the oven to the sides. Four 4½-inch arches, 9 inches wide, are then thrown off the middle retorts, to receive the top retorts, and the back chamber wall carried up; and after all being levelled across, so as to leave a space of 3 inches between middles and tops, the two retorts are run in, and placed so as to leave 3 or 4 inches between the bodies of the same. These, in turn, are blocked at the bottom with feather-edges, as well as in the centre, and suitably stayed on top to the arch of the oven. The retorts, and all internal brickwork, receive several coats of Purimachos cement, which seems to prevent the adhesion of dust, and protects the oven, as well as the brickwork, from the fire.

The furnace gases enter the setting at the floor, in the centre; rise and flow over the bottom retorts towards the back, along the walls of the oven, down at the ends of the retorts, over the bottom retorts into the back gas chamber, over the middles, and over the tops to the back chamber; then spilt and traverse under the bottom retorts, between the 14-inch furnace-wall and the midfeather wall to the front of the bench; turn outwards to the flue between the midfeather wall and the side of the oven; then to the back of the oven, up an upright flue on each side of the setting to the main flue, where there are two dampers—a convenient way of ensuring an even heat when a cold bench is next to the one in action.

This forms the standard setting here; and it is very uniform in heating—both from end to end of the retorts, as well as all round the setting itself. It renders blocked ascension-pipes a rarity—with Newcastle (N.S.W.) coal; scarcely ever more than a few inches beyond the mouthpiece being choked, even when gaseous firing is used, and a yield of 8000 cubic feet of gas per mouthpiece obtained. White's anti-dip valves are used; the gas supply being through 2-inch pipes, attached to bridge-pipes over the dips, and a separate 12-inch main to collect the gas. The tar and ammoniacal liquor run into the hydraulic main as before, and through a tar-main to the well. These 2-inch mains, though answering with ordinary firing in the furnaces, prove to be incapable of taking away the gas now; and they will shortly be replaced by larger ones.

In starting the system of gaseous firing, the greatest difficulty met with proved to be the admission of secondary air; and the pages of the JOURNAL OF GAS LIGHTING were diligently searched for well-defined rules to guide the fixing of the proportions of air, but with small success. Some were positive that the primary air should be in excess, and others maintained the contrary; so the conclusion arrived at was that, as each wanted various proportions (influenced doubtless by the style of setting, length of the flues, height of the chimney, as well as by the distance from the chimney), the safest plan was—*to find out.* Careful measurements were made of the primary and secondary airs, the coals were weighed, the coke was measured, and the make of gas per mouthpiece was noted. This was done during 72 hours; and then the slides were altered, and the setting allowed to run for 96 hours, before nother testing was entered upon.

The figures given in the appended tables speak for themselves. No. 1 bed was the standard setting employed here. No. 2 bed was so arranged that the primary air entered the setting in the same positions as in No. 1; but the secondary air entered through port-holes under the bottom retorts, and the course of the furnace gases was also distinct from the standard setting. The gases leaving the port-holes went in four sheets among the retorts, and round outside the bottom retorts, which were set 3 inches away from the sides of the oven; then over a partition 5 ft. 3 in. high to the back chamber; then they were split under the ends of the bottom retorts, and went straight up the main flue.

Results of Subsequent Trials.

No. 1 Bed, with 9-inch by 4-inch Nostrils.—Owing to inferior bricks being employed in the sides of the gas-duct, the nostril blocks were left without support, and fell in; and both they and the bricks got badly mixed up. The tile which covered the neck of the gas-duct from the generator followed suit at the end of the winter; and, of course, necessitated repairs. Advantage was taken of this to employ arch-bricks (Cliff's Aluminous) over the duct leaving the generator, as well as to form 14-inch rings, 9 inches thick, over the duct inside the setting, which allowed the use of four nostrils, each 11 inches by 6 inches, for the two gases to enter the combustion chamber, in place of the 9-inch by 4-inch ones as before. The sides of the duct were lined with Glenboig bricks; a "straight joint" having been left, to facilitate such repairs. These nostrils answer admirably; the retorts being untouched, save for the usual patching given when let down. The yield of gas has reached 8000 cubic feet per mouthpiece; the primary air passage being 16 inches in area, and the secondary air passage 8 inches in area.

No. 2 Bed, with 9-inch by 4-inch Nostrils.—The bricks in the sides of the duct ran even worse than in No. 1 bed; and towards the close of the winter a large hole was the result, behind the front wall of the setting. The bricks became run together in the duct with the pieces of nostril blocks. The course of the furnace gases increased the heat of the bottom retorts beyond that of the tops or middles; and the ascension-pipes of the bottom retorts, from the increased mouthpiece heat, began to block up. As the retorts in this bench were worked out they were removed, as well as the outside generator; and the generator is now placed inside the setting, and consists of a straight opening, parallel throughout, 18 inches wide, 3 ft. 9 in. long, and about 5 ft. 6 in. deep. The secondary air enters at the sides of the generator at the oven floor-line (three 4½-inch by 2½-inch openings each side); and the course of the furnace gases and the style of setting is altered to the standard. The yield of gas per mouthpiece is 8000 feet; and the economy of fuel is 15 per cent. over the outside generator—dry steam being used at the hearth, which has no fire-bars, in place of steam and water. A further economy of £60 in erection is obtained over the outside generator. This furnace furnishes the next step of improvement; and is being supplemented by the full-depth recuperative furnace previously mentioned.

It will be worth noticing that, in the matter of nostrils, the first start was with 9-inch by 2½-inch ones, then 9-inch by 4-inch, 11-inch by 6-inch, and finally one large nostril 3 ft. 9 in. by 1 ft. 6 in. The latter style claims attention, on account of its being the simplest in construction, permitting an easy flow of the gases among the retorts; and it is not complicated in working, nor does it require any fancy designs of blocks or quarries. In fact, the design of the new recuperative furnace calls for the utilization of about twelve plain tiles 24 inches by 15 inches by 2½ inches, and about sixty tiles 18 inches by 11 inches by 2½ inches. These tiles are plain, not rebated; and when, in cutting out No. 2 furnace, the tiles were taken out to suit the alteration of setting, they were found to have been air-tight, which fact is attributed to the employment of careful labour, as well as to the admixture of Purimachos with the fire-clay.

It will, therefore, be observed that a somewhat fresh departure is taken from the beaten track of generator setting, inasmuch as no "specials" (beyond the enumerated tiles) are employed, and the rest of the work is completed with such bricks as squares, splits, feather-edge, arch, and bevels. It has been found that a large surface for fire-clay material is a source of danger from cracking; and therefore preference is given to ordinary materials. There is, moreover, less risk of damage from transit, as well as a cheaper article, both in first cost and in packing—a by no means inconsiderable item in these parts.

The following tables will, it is hoped, speak for themselves, as showing the effect of various admixtures of primary and secondary airs; and they may be somewhat at variance with accepted ideas. Tables A and B represent actual results during 72-hour tests, and they show

conclusively that an excess of secondary air cools down the setting. In the instances given, the effect was noticeable; but it was thought desirable that the test should continue, and the figures be tabulated for future reference, even though some loss might arise in the shape of fuel and production of gas. Table C gives information culled from various sources; and will explain the difficulty in arriving at any well-defined rule as to the proportions of primary and secondary air. The authorities, where practicable, are added; but a few examples are not so treated, as the information was not given with any idea of public property being made of it. Examples Nos. 3 and 4 are from the same works; and Nos. 5 and 6 are from different works, and are examples of regenerative firing as practised in the Colonies adjacent. In Nos. 7 to 10 inclusive no waste gases are utilized; and the secondary air is heated by contact with hot brickwork on either side of the gas-duct and below the floor of the setting.

TABLES A *and* B, *showing Result of Varying Proportions of Air.*

——	Test No. 1.	Test No. 2.	Test No. 3.	Test No. 4.
A.—*No. 1 Bed.*				
Primary air. . area in inches .	9	12	18	18
Secondary air . " .	4½	6	12	9
Coal carbonized . . . tons .	9·75	10·5	11·55	10·65
Duration of charge . . hours .	4	4	4	4
Coke sold . . . . . bags .	123	121	142	146
Breeze sold . . . . " .	5	4	5	5½
Make per mouthpiece . c. ft. .	5600	6020	6420	5917
B.—*No. 2 Bed.*				
Primary air. . area in inches .	7½	9	18	18
Secondary air . " .	25½	18	12	9
Coal carbonized . . . tons .	9·15	8·55	13·05	13·05
Duration of charge . . hours .	4	4	4	4
Coke sold . . . . . bags .	100	87	146	154
Breeze sold . . . . " .	4	2	6	7
Make per mouthpiece . c. ft. .	5250	4890	7500	7500

TABLE C, *showing the Various Proportions of Primary and Secondary Air claimed by Authorities.*

No. of Example.	Air Supply.	Area in Inches.	Authority.	Remarks.
1	Primary	25	J. G. L., 20/12/87, p. 1095.	Full.
	Secondary	12½		
2	Primary	12,000 ft. per hour	J. G. L., 21/2/93, p. 314.	Regenerative.
	Secondary	28,000 ft. per hour		"
3	Primary	18	—	
	Secondary	10		"
4	Primary	9	—	
	Secondary	10		"
5	Primary	4½	—	
	Secondary	18		"
6	Primary	27	—	
	Secondary	4½		"
7	Primary	22	T. S. Cleminshaw	Half depth furnace.
	Secondary	8	Furnace 3′ 0″ × 18″	5 feet deep.
8	Primary	15	" "	8000 feet per mouth.
	Secondary	5	Furnace 3′ 9″ × 18″	
9	Primary	16	" "	11 in. by 6 in. nostrils.
	Secondary	8	Outside generator	8000 per mouth.
10	Primary	18	" "	9 in. by 4 in. nostrils. 6416 ft. per mouth.
	Secondary	12	Outside generator	Same setting as No. 9.

In conclusion, it is thought that the following deductions may be drawn from the preceding notes:—

(1) That the amount of primary and secondary air should only be fixed after careful and searching trial.

(2) The amount will vary in each case according to the style of setting, length of the flues, and draught of the chimney. (In the present case, the chimney was on the end of the bench, 2 ft. 3 in. by 2 ft. 3 in. top and bottom, and 61 ft. 6 in. high.)

(3) Only the best materials, supplemented by careful labour, should be employed, finally finished off with a wash of Purimachos.

(4) The employment of small nostrils from the gas-duct, seems to be a mistake, as shown in example No. 10; the alteration, as in example No. 9, increasing the result per mouthpiece, without the setting receiving any alteration.

(5) The style of setting obviates, to a greater degree, that *bête noire* of gas engineers stopped ascension-pipes; and this is attributed to the fact that the course of the furnace-gases is taken towards the backs of the retorts, giving uniform heats, and keeping the mouths of the retorts cooler than when the gases are brought to the front of the setting, under the bottom retorts, up a back chamber, and then through an opening in the crown of the arch to the main flue.

(6) Last, but by no means least, there is a distinct saving by the proper use of gaseous fuel, of room, wear and tear, fuel, labour, and coals.

THE GAS AND ELECTRICITY SUPPLY OF BLACKPOOL.

By WILLIAM CHEW, M.Inst.E.E., of Blackpool.

To the members of this Institute, consisting of gas engineers, the part of this paper having reference to electricity may perhaps be thought a subject foreign to their interests. At one time, no doubt, this would have been the case; but the development of electrical knowledge during recent years has placed in the field previously held by gas a new agent, as a competitor therewith, for lighting, heating, and motive power. As this new agent seems destined to create a disturbing element in the future prospects of the gas industry, and as the advisability, or otherwise, of having a dual supply is occupying the attention of local authorities throughout the country, I propose in this paper to lay before you an account of the work undertaken at Blackpool, which I trust will be of interest to the members generally. The town of Blackpool, as most of you are aware, is the seaside watering-place of Lancashire. Its requirements may therefore be taken as typical of those of other towns; and the grounds on which the Corporation decided to have a dual supply are also applicable elsewhere, though perhaps in a less degree.

Commencing with the gas supply, as being the oldest and most important undertaking, let us examine how far it has fulfilled its purpose, and wherein lie the shortcomings that render it at all necessary to have an auxiliary supply by means of electricity. Without going into ancient history, which is well known, as to the origin of any gas-works, it is evident that at some time or other the Blackpool Corporation became possessed of such works, and at the present time, in addition to their original purpose of lighting only, have added that of supplying an agent for cooking, heating, and motive power. Experience has proved to them that for these purposes the use of gas has been well adapted and thoroughly reliable; and that, from a monetary point of view, it could be sold remarkably cheap in comparison with other agents, and at the same time yield a handsome profit on the investment.

However satisfactory these results in the use of gas may have been in the past, we must not overlook the fact that advances have been made of late years in matters of hygiene; and already this class of criticism has been brought to bear on the use of gas, with a view to discourage its adoption wherever possible. Exception is now taken to the combustion of gas in the production of light; and in this lies the chief advantage attributable to electricity as a lighting agent. Under ordinary conditions of usage, light from gas is obtained by combustion—the waste products and heat generated being radiated in the surrounding space; and should this happen to take place in a badly-ventilated room, it will tend to further vitiate the air thereof. Further, with some burners an amount of unconsumed carbon is released; and this combines with the deleterious particles floating on the atmosphere of rooms, depositing itself at times in inconvenient places.

I am aware that these drawbacks to the use of gas have been greatly exaggerated, and apply only in a slight degree in the majority of uses to which gas is put. But taking as an example an ordinary apartment, where gas is only used about four out of the twenty-four hours on an average, we find so many counteracting agencies at work, that any chemical theories built upon the basis of the constituents of burning gases are rendered almost neutral in their application, owing to the circulation set up in a heated room from unseen sources. Were this not the case, owing to the depletion of oxygen and the increase of carbonic acid that can be calculated to have taken place in a room through the use of illuminants—such as gas, oil, or candles—the same would soon become uncomfortable for habitation. But this does not happen

where ordinary ventilation is allowed to take place. Nevertheless, we find that there are a good many cases where ventilation is neglected, and circulation takes place in a haphazard sort of way; and as the tendency of the age is to have much more light than formerly, the result in such instances is an aggravation of existing evils. It is in this direction, then, that gas scientists must turn their attention, if they are to meet these modern requirements; and already there are signs of a new era dawning for the production of light from gas, on the lines of the Welsbach burner, which, besides cheapening the cost of light, has far higher hygienic properties than previous burners in use—so much so that already its sale has had a marked effect in limiting the use of electric light on the Continent, where the burners have been introduced on a large scale. These are the principal arguments advanced against the use of gas; and it is with a view to obviate these drawbacks, that some sections of consumers are turning their attention to electric lighting.

We know that the requirements of all consumers are not alike in this respect; and that there are a certain number to whom it is a matter of importance to have a lighting agent giving a low calorific effect, with freedom of combustion, and a certain convenience of manipulation. To these, the question of cost is sometimes a secondary consideration, in comparison with the advantages supposed to accrue indirectly. It was for this reason, and on the assumption that there were many of this class of customer in our town, who could well afford to pay for such lighting if made available for them, that our Corporation decided to put down an electricity works to supply the central parts of the town.

Before finally deciding to proceed, opportunity was taken to inquire into the demerits as well as the merits of the new system and its properties generally, in comparison with gas lighting. The plant required for its production was found to be much simpler than gas plant; a rotary alternator, driven by an engine, being all that was required to produce it on a large scale. But the distributing plant was more complicated, owing to the absolute necessity of having an uniform pressure. From this cause, it appears that, although the amount delivered could be measured approximately by meter, yet it did not always follow that a given amount registered produced the same amount of light, even with the same lamps in use. Again, a most important factor was met with in the instability of the secured custom of large consumers, owing to the facility with which a private installation can be put down, and, if worked with cheap gas power, the electricity produced on the spot at less cost. This was soon manifest; for already in Blackpool there are four private installations in operation, having a working capacity of 200 units, or equal to the size of the central electricity works. So important does this question become, that immediately after the capital is expended the large customers are practically able to determine the price charged within very narrow limits to themselves; otherwise their custom, so essential to success, is lost, thereby entailing charges for unemployed plant, &c.

Electricity yields light or heat whenever a suitable resistance is offered to its passage; and this property is taken advantage of to obtain light in glow lamps. By means of raising a fine thread filament to incandescence (which can be accomplished by proportioning its thickness to the pressure and quantity of electricity passing through it), various degrees of light and heat are produced. The terms used to express these quantities in technical language are as follows:—

Resistance.—The standard is called an "ohm," being the resistance offered by 129 yards of No. 16 copper wire.
Volt is the standard of pressure.
Ampère " " quantity.
Watt-hour " pressure × ampères × hours.
Unit " " kilowatt-hours, or 1000 watt-hours.

As I have already mentioned, the production of light depends on the quantity and pressure being maintained. So much so is this the case that, taking an ordinary glow lamp placed on a town main, where the pressure should be maintained at 100 volts when the standard light given out is 16 candles, should there be any falling off in pressure, the light diminishes at about seven times the rate of the drop. Thus, should the pressure fall (say) to 96 volts, the light given will be reduced to about 12 candles; and if the pressure rises above 100 volts, the opposite is the case. Then again the life of a lamp varies with the change of pressure as follows:—

Standard at 96 volts, 2700 hours' life, yields 12 c.p. nominal.
" " 100 " 1000 " " 16 " "
" " 105 " 300 " " 20 " "

Throughout the nominal life of a lamp, the light gradually diminishes; so that the real effective life is much less for lighting, if we assume a lamp to be used up when the light drops from 16 to 14 candle power. The result of this to a consumer is that, although he may pay for a certain quantity of electricity, there are many considerations before he gets his equivalent in light.

The method of charging for light affords a similar analogy to that of gas, where the consumer, buying light, is supplied with a unit of gas, called 100 cubic feet—costing 3d. at Blackpool—which will yield him, when burnt in a standard burner, 3·6 sperm candle power per hour from each cubic foot used. In burning gas, however, the result depends on a minimum pressure being used; and this is under control at each burner—the pressure in the mains being kept slightly in excess of actual requirements in consequence. Though electricity is not sold in cubic feet, yet it fortunately so happens that the unit by which it is measured yields nearly the equivalent in light of 100 feet of gas; so that for purposes of comparison of cost, a unit of electricity and 100 feet of gas approximately correspond. Electricity, then, is charged by the unit; and this is equivalent to the quantity of electrical energy supplied in one hour by a current equal to 1 ampère, which, multiplied by the pressure, yields 1000 watt-hours, and is commonly called a kilowatt-hour. Applying this rule to lighting, it is known that an ordinary long-life glow lamp takes 4 watts per candle for each hour used; but there are short-lifed ones that can be had, taking 3 or 2½ watts per hour only. The best lamp to use is a matter for experts to decide; for, owing to the fluctuation in pressure on town mains, the rapid diminution of luminosity at different pressures, and other causes, it involves almost a mathematical calculation, suitable only to electricians. Until we get a lamp that will maintain a standard light, there are other costs incurred besides those for current, just as there are in some forms of gas-burner. For outside lighting and large spaces with arc lamps, these remarks do not apply; as for this purpose, I think electricity has no rival in the field.

These, then, are a few of the results found to be inseparable from an electrical supply; and when it is known that it is a physical impossibility to maintain an even pressure on all the mains, it will be patent that these are no little obstacles to be overcome as soon as the electrical company have emerged from the embryo condition in which most works are now placed.

As to the relative direct values of the cost of lighting, irrespective of the little shortcomings of both systems, the following is an approximate estimate of the cost of maintaining a 16-candle power light by gas and electricity at Blackpool:—

For 1000 *Hours per Annum under all Conditions.*

BLACKPOOL GAS.

Standard Value, 18-Candle Power, charged at 3d. per Unit, or 100 Cubic Feet.

Burner Used.	Candles Per Foot.	Cost of 1000 Hours.	Add Maintenance.	Total.
Argand	3·6	11s. 0d.	1s. 0d.	12s. 0d.
Special	3·0	13 3	0 6	13 9
Common	2·5	16 0	0 3	16 3
Bad	2·0	20 0	..	20 0
Regenerating . .	10·0	4 0	Not	known.
Welsbach . . .	20·0	2 0	Not	known.

BLACKPOOL ELECTRICAL SUPPLY.

Standard Glow Lamp, 16-Candle Power, charged at 6d. per Unit.

Glow Lamps, Watts Per Candle.	16 C.P. Watts.	Life of Lamp (estimated.	Cost of 1000 Hours.	Maintenance.	Total.
4	64	1000	32s. 0d.	1s. 6d.	33s. 6d.
3½	56	750	28 0	2 0	30 0
3	48	500	24 0	3 0	27 0
2½	40	..	20 0	Not	known.
2	32	..	16 0	Not	known.

These tables are necessarily founded on estimated cost; and are only to be taken inferentially—actual tests not having been made under ordinary working conditions.

After reviewing all the foregoing facts, it is palpable that electricity as a lighting agent has a certain commercial

value; and given the possibility of sufficient support at the commencement of the undertaking, there is no reason why this agent should not be utilized to general advantage. This was the view taken at Blackpool before starting the works. I should here mention that still further confidence was given by the Corporation having had an electrical station going for 13 years previously, so that they had some knowledge of their own of its capabilities. In this works of an older type, electricity used to be produced at 3d. per unit; and on a larger scale, with modern plant, it was expected a less figure would be reached. During the periods between these years, various estimates were got out for a general scheme; and, as showing how unnecessary caution had perhaps been used, it was always assumed that a constant supply would be required, and under the knowledge at that time obtainable it was considered impossible from economical grounds. Eventually, after seeing the working in other towns, this was ignored; and we started to supply from dusk till midnight, which is now increased to an 18 hours' supply out of 24, although a compulsory supply can be demanded constantly. It is owing to the electric companies not always fulfilling their obligations, that a good deal of preliminary success is attributable.

Concluding these remarks on the subject, I will take the opportunity to describe the manufacturing plant of both agents; commencing with the gas plant and following with that used for the supply of electricity.

The gas-works are alongside the local railway, with sidings and communication thereto. There are two gas-producing houses. No. 1 is a ground-floor house with subway, 140 feet by 60 feet inside; and it contains 26 single ovens having 156 mouthpieces. No. 2 house is 220 feet by 100 feet inside; and it contains 18 through ovens, having 216 mouthpieces—the size, as in the other house, being 22 inches by 16 inches. The total number of mouthpieces, therefore, is 372, set in 62 ovens. The retorts are all heated by gaseous firing from 31 producers; being one to each twelve mouthpieces. Both machine and hand stoking are employed. The coals used for carbonizing are chiefly from the Wigan district, with the addition of cannel, to raise the illuminating power to 18 candles. The coal storeage is alongside and between the two houses; and to manipulate the raw materials—the coal, coke, &c.—a steam locomotive, travelling crane, and fixed whipping crane are employed, a high-level line being in use throughout the works.

The gas, as it leaves the producers, has the denser hydrocarbons constituting the tar immediately extracted; and it is then received in the foul-mains, in which are fixed hot friction screening appliances, for the precipitation and splitting up of the globules held in suspension, usually allowed to be carried with the stream of gases to the coolers. At the proper temperature, the gases are admitted to the air condensers, having a large adjustable surface capacity for cooling purposes. In this apparatus, the suspended water vapour, beyond the carrying power of the gas at a reduced temperature, is deposited in receivers. Experience has shown that it is essential to carry on distillation and condensation at a low pressure, and in a rarefied condition, to liberate the hydrocarbons.

At the end of these coolers, a set of rotary exhausters is so placed as to relieve this portion of the process from the high pressures caused by the purification and storeage plants. These exhausters press the gas forward, first through the concentrated liquid process of purification, consisting of a tar-extractor and tower scrubber, for the extraction of a percentage of the carbonic acid, sulphuretted hydrogen, and ammonia compounds; the remaining portion of the ammonia being removed by absorption in pure water in a separate machine.

These complete the liquor process of purification; that by the dry process being here taken up for the removal of the sulphuretted hydrogen and carbonic acid. There are, for the first-named impurity, four purifiers, 30 feet square, filled with oxide of iron for its absorption and deposition as a crystalline sulphur deposit therein. The carbonic acid is finally removed in four calcium purifiers, each 20 feet square. Final tests are here taken; and only gas that is free from these impurities is then registered by a large meter, and stored in the receiving vessels so characteristic of the locality of a gas-works. The gas being measured into the holders, the total used (as indicated by the consumers' meters) shows the loss in distribution.

The storeage capacity is 1,400,000 cubic feet, or equal to 27 hours' supply at the time of maximum demand. It is contained in two holders—a treble-lift one and a double-lift one—containing 600 and 800 thousand feet respectively. The ammoniacal products yielded from the manufacture are worked up on the spot into commercial sulphate, which is in demand as a fertilizer. Coke is sold locally; and some is sent away to other towns. Tar is forwarded to the distiller out of town, though a reserve tar-distilling plant is kept on the premises, to be used whenever desirable.

In the distribution of gas, the first essential is that the pressure should be maintained throughout the system at not less than that fixed by the Act—this being the minimum allowed; and no part should have excess of pressure to compensate for insufficiency of main in other parts, as this excessive pressure tends to increase the leakage. The gas being stored in the holder at high pressure, is reduced to low pressure by means of a converter or governor, and distributed with a low-pressure system of mains. There are large principal mains, with subsidiary mains leading therefrom, one in each parapet of the street; these latter being chiefly 3 inches and 4 inches diameter. The services are, with rare exceptions, all lead, and are laid in solid grooved troughing. There are about 50 miles of mains laid; and as proving the efficiency of the system, the leakage for a great many years averages 4 per cent. only. The internal fittings are subject to inspection; the bye-laws forming the basis of all plumbers' contracts. Architects generally insert a clause stipulating the bye-laws in dimensions of pipes; and this relieves them of a deal of responsibility. A special bye-law is in force as to the supply to stoves; and pipes laid in accordance with this ensure a perfect supply. The bye-laws were adopted after actual experiments with different sizes of stoves, at varying pressures and lengths of pipes.

Below is an abridged copy of the dimensions and forms.

3.—With respect to the internal fittings, the following are the sizes and lengths of iron or lead to be used in the premises, according to the number of burners required:—

Internal Diameter of Pipe.	Greatest Length allowed.	Greatest Number of Burners allowed.
⅜ inch	20 feet	3
½ "	30 "	6
⅝ "	40 "	12
¾ "	50 "	20
1 "	80 "	40
1¼ "	100 "	60
1½ "	150 "	100
2 "	200 "	200

4.—With respect to gas-stoves, the following regulations must be observed, as to the sizes of the pipes and the lengths allowed:—

Average Inside Size of Oven.	Distance of Stove from the Meter.	
Stove No. 0—11 in. × 11 in. × 14 in.	Under 30 ft.	½" pipe required
" " "	If 60 ft.	⅝" " "
Stove No. 1—14 in. × 14 in. × 24 in.	" 30 ft.	⅝" " "
" " "	" 60 ft.	¾" " "
Stove No. 2—15½ in. × 15½ in. × 24 in.	" 30 ft.	¾" " "
" " "	" 60 ft.	1" " "
Stove No. 3—19 in. × 18 in. × 24 in.	" 30 ft.	1" " "
" " "	" 60 ft.	1¼" " "

BLACKPOOL,

Date _____ 189

TO THE GAS ENGINEER,

I, _____ hereby give you Notice that I have completed the laying of the Gas-pipes in the manner required by your Regulations, at Nos _____ Street, the property of Mr. _____, and the work is now ready for your inspection.

Size of Main Pipe _____

No. of Preparations _____

No. of Burners _____

Size of Stove (or Stove-Pipe) _____

(Signed) _____ Plumber.

Address _____

N.B.—Plumbers must send this form to the Gas Office at least three days before plastering is commenced.

No covered pipes will be passed.

INSPECTOR'S REPORT.

I have inspected the above, and find them as stated (except _____ and I recommend that the work be passed, and a _____ inch Service-Pipe be laid.

Distance from nearest Main _____ feet.

(Signature) _____ Inspector.

Date _____ 189

The standard pressure at which gas is sent from the station is, from sunset till 11 o'clock, 24-10ths; it being then gradually reduced to 8-10ths, till morning time, when it is increased to 14-10ths for the remainder of the day, except in the season proper, when what is termed stove pressure is applied at noon. The number of consumers attached to the mains is 5700; and out of this number there are 2500 gas-stoves owned by them, and 60 gas-engines. The effect of these cooking stoves on the consumption during the season is very marked, and causes rapid fluctuation in the demand, which greatly affects the storeage capacity. The bulk of these stoves are idle during the winter months; and it is owing to this cause that our heaviest day's output is usually on the August Bank Holiday, which time, unfortunately for carbonizing, is the hottest period of the year. The maximum day's output is 1,250,000 cubic feet, against a minimum of 350,000 feet. There are 1400 public lights in the borough; and these are in charge of the gas department.

The total amount of capital expended on the works to the present time is:—

Land and buildings	£23,019	= 24 per cent.
Apparatus	40,034	= 41½ " "
Mains and services	22,634	= 23½ " "
Lamps and posts	3,196	= 3 " "
Meters	7,617	= 8 " "
Total	96,500	= 100

Towards the liquidation of this sum, an annual amount has been set aside, which now amounts to about £12,500; leaving the actual indebtedness at £84,000. With this capital, we made this year (to March 25 last) 242 million feet; being an increase of 34 millions over the previous year. I anticipate that, with an expenditure amounting to £3500 more, we shall make 300 million feet per annum; so that the structural cost is £333 per million feet made per annum, or equal to 8d. per unit of 100 feet.

The financial results of the past show that, while the Corporation have set aside for redemption fund £12,500, they have also profited, during the last ten years alone, to the extent of £40,000, and at the same time given reductions in price from 3s. 9d. to 2s. 6d., which amount to another £40,000; making a total of £92,500, or almost enough to extinguish the debt, if so applied.

The result of the last years working shows that the following profit has been made and applied:—

Interest and sinking fund	£4342	= 4½ per cent. on capital.
Town's purposes	5590	= 6 " "
Total	£9932	= 10½ " " "

As a result of the year's working, gas is now reduced to 2s. 4d. per 1000 feet, with a free meter still.

I will now describe the new electric works as fully as possible, that we may be acquainted with the class of competitor the new agent is likely to assume.

Wherever electricity works are first commenced for a general supply, it is difficult to forecast precisely the amount of light immediately required; but in Blackpool there are exceptional circumstances that cause a very large demand in proportion to the size of the town, from the existence therein of so many places of public resort, which vie with one another.

An approximate estimate was based on the requirements of these places; and a 200-unit glow-lamp plant, with an 82-unit arc-lamp plant was fixed upon. Acting on this, electrical contractors were invited to submit estimates and designs, with the result that the works have been erected at a cost of £30,000. This was thought a large outlay; but it was estimated that, if only one-half was immediately put in operation, there would be little loss, whilst if the output should ever reach the capacity of the plant, then the profits would fast accrue, owing to certain fixed charges being almost stationary. This is the universal opinion of all electricians, even those that have half a million of capital laid out. The system adopted was that known as the alternate-current high-pressure system, with a converter to low pressure fixed in each consumer's premises; and for public lighting, a separate plant on the direct-current high-pressure series system.

The works, which adjoin the gas-works and their railway sidings, consist of a boiler-house 123 feet by 68 feet, and a producer-house 123 feet by 55 feet. There are three Lancashire boilers, 28 feet by 7 feet, fitted with mechanical stokers, and apparatus intended for the consumption of smoke.

The producing plant for glow lamps consists of—

		Volt.	Amp.	Rev. per Min.
No. 1*a*	100-unit rotary alternator	2000	× 50	375
" 1*b*	— 50 " " "	2000	× 25	
" 1*c*	— 50 " " "	2000	× 25	

Total 200-unit output capacity.

The driving power for these consists of compound coupled horizontal non-condensing engines.

No. 1*a*—200 I.H.P. at 90 revs. and 125 lbs. steam.
" 1*b*—100 " 120 " 125 "
" 1*c*—100 " 120 " 125 "

the power being imparted by cotton ropes.

The arc light plant consists of—

No. 1 dynamo	27½ units,	maintaining 55	arc lamps of 10 ampères.
" "	27½ "	" 55	" "
" "	27½ "	" 55	" "
Total	82½ units	" 165	arcs

These machines run at the rate of 800 revolutions per minute; and are each driven by a 60 indicated horse power engine, the same type as the others.

This constitutes the plant of the producer-house; the current being taken from each machine to a distributing board for combining or bye-passing the various circuits required. A testing resistance equal to the output of the largest producer is provided to be used when required. A suitable overhead crane for repairs is fixed to travel on the walls; and beyond several small testing instruments for measurement of current and pressure regulators. This constitutes the whole of the generating plant.

In the distribution of the current, great care has to be exercised in apportioning the sizes of the mains, owing to the cost of copper contained in them, and the loss of pressure if at all too small; for with too small leads, it is easy to expand 50 per cent. of the production in overcoming the resistance. The distributing-mains are laid in 3-inch and 4-inch diameter turned and bored pipes on each side of the streets, in straight lines, with a brick-eye at easy distances. The cables are stranded copper wire, insulated with vulcanized india-rubber, and threaded into the pipes. These were laid without attempting to keep them watertight, as the quality of the insulating material was so good. Being laid in straight lines, about 18 inches deep, they necessarily overlap the gas-mains; and are liable to accumulate gas therein owing to disturbance of the earth in laying them. The effect of this will probably be seen later on, when the precise nature of the disturbance has been forgotten. The main leads are taken along some of the principal streets, at 2000 volts pressure, and to consumers' houses, where the converters are fixed to yield 100 volts pressure to feed their lamps.

A two-night test at one consumer's premises shows the effective pressure obtained therein.

Time.	Volts. Pressure.	Time.	Volts. Pressure.
7.10	108	7.25	111
7.22	104	7.40	107
7.25	94	7.41	94
7.28	96	7.47	99
7.30	94	7.50	96½
7.40	93½	7.58	97½
7.45	94	8. 0	100
7.51	96	8. 1	96½
8. 0	94½	8.13	96
		8.30	96½

From this it will be perceived how difficult it must be to keep at 100 volts steadily, if under penalties.

There have been about 8000 yards of mains laid containing 20 lineal miles of wire; and on these are fixed about 60 consumers, several being very large ones. The public lighting is carried out on a brilliant scale on the Marine Parade; the lamps being about 50 yards apart and 25 feet high. They each use ½ unit of current per hour; and are known as 2000 nominal candle power. In the main streets, 25 others are being erected. These displace 200 gas lights.

The works were put in operation on Aug. 1, 1893; and the cost was as follows:—

Land (rented)		
Buildings	£8,008	= 26½ per cent.
Apparatus	10,500	= 35 "
Mains and services	7,000	= 23½ "
Lamps and posts	4,000	= 13½ "
Meters, &c.	500	= 1½ "
Total	£30,008	= 100

The output of the plant is calculated at 150,000 units per annum, equal to 4s. per unit made. In order to push the new light, the usual pamphlet was issued setting forth the hygienic capacity of the light in comparison with gas,

and a few rules as to insulation requirements of consumers' leads. Canvassing consumers is strongly pursued also.

The scale of charges for current are scheduled as follows: Glow lamps by meter at 6d. per unit, with a discount ranging from 5 to 25 per cent. For private arc lighting, 2d. an hour for ½ unit lamp equals 4d. per unit, less 10 per cent. discount. Promenade and town lighting at actual cost of current, *plus* maintenance.

As a result of starting the plant, the guaranteed customers to the extent of about 60 were quickly supplied; one of these taking alone fully one-third of the entire private consumption. The Corporation themselves are also large users, coming in for nearly half the total output, which, for the eight months previous to March 25, was:

Produced at works for private use	55,600 units.
" " public lamps (only half lit during winter)	22,560 "
Total	78,160 "

The works are now employed at their maximum output, the reserve plant being encroached upon thus:

Available output in one hour = 200 units	
Actually in use	195 "
Balance (reserve)	5 units, or 2½ per cent.

Arc Plant.

Available	155 arcs
Actually used	140 "
Reserve	15 arcs, or 10 per cent.

The following table will give an idea of the extent of the lighting since the commencement:—

Schedule of Output per Week from Sept. 1, 1893, to March 1, 1894.

Date.	Alternating.	Public.	Private.	Total.	Working Cost
1893.					£ s. d.
Sept. 9	1,265	..	..	1,265	47 5 5
16	1,691	..	..	1,691	44 6 0
23	2,086	..	173	2,259	42 17 1
30	2,026	..	337	2,363	48 11 3
Oct. 7	1,620	..	128	1,748	51 9 1
14	1,800	..	195	2,435	64 3 3
21	1,693	1,332	102	3,107	72 9 4
28	1,594	1,349	128	3,071	68 10 4
Nov. 4	1,685	1,369	140	3,194	64 19 1
11	1,786	992	195	2,973	59 19 4
18	1,660	895	98	2,653	41 6 9
25	1,628	823	133	2,584	39 10 4
Dec. 2	1,727	842	157	2,726	39 18 10
9	1,838	861	281	2,980	41 5 8
16	1,779	888	202	2,869	39 12 3
23	1,797	929	104	2,830	38 1 1
30	1,880	993	246	3,119	41 11 3
Units	29,555	11,713	2619	43,867	845 16 4 = 4·7d. p. unit.
1894.					
Jan. 7	1,781	948	145		
14	2,150	959	355		
21	1,903	943	238		
28	1,726	877	236		
Feb. 4	1,922	793	278		
11	1,728	816	220		
18	1,566	896	92		
25	1,634	745	114		
26 & 28	691	311	43		
Estimated to March 25.	44,656	18,911	3940		

Summary.

Produced to March	Incandescent lamps	44,656 units.
" "	Public lighting	18,911 "
" "	Private arcs	3,940 "
		67,507 "
March 25, estimated		10,719 "
Total product		78,226 "

As there are several more customers ready to come on, the extensions of the mains to supply them have already been put in hand; and a temporary plant has been put down till the permanent one can be erected. This new outlay will raise the capital to about £50,000; and the incandescent capacity will then be raised from 200 units to 450 units per hour.

One result peculiar to new electrical works is that the cheap high-tension distributing pioneer system of separate transformers has in six months to be replaced with a new low-tension system of distribution in the centre of supply, by means of half-a-dozen transformers placed in the streets. In this way the difficulties attending the pioneer work will be reduced, as all house transformers will be abandoned where this system prevails. This is the second step towards having a central transformer station in the middle of the town where the future current will no doubt be distributed from—forming a kind of town governor-house.

The result of the first half-year's working can hardly be taken as a standard of future cost; the plant being partly in the hands of the electrical contractors, so that many items chargeable will consequently not appear. Besides this increased output for longer periods is expected from the plant hereafter, which should tend to reduce the comparative costs. The total output to March 25 has been—

Aug. 1 to December		43,867 units.
December to March 25		34,359 "
Total		78,226 units.
The working cost of producing this has been	£1774 =	Per Unit. 5·44d.
Proportion of interest only chargeable for this period	629 =	1·93
	£2403 =	7·37d.
Add if the whole interest and sinking fund for eight months had been chargeable = £1150, at 5¾ per cent.	521 =	1·60
Total	£2924 =	8·97d.

The cost per unit sold is rather difficult to apportion in this necessarily experimental period, owing to waste caused by trials of plant, and which are recorded in the output only, and might be misleading. The loss on distributing of the incandescent system alone is about 25 per cent. of the output; that for the arcs being almost negligible, owing to the mains being in use during the time of actual lighting only. This working cost is undoubtedly a high figure in comparison with the selling price; but as the plant has reached its maximum capacity, and the working cost has had the advantage of freedom from repairs, rates, and depreciation, it is clear that any reduction on cost must be in the direction of longer average daily loads, coupled with sundry economies, and the very doubtful advantage of a larger station. I have not given a detailed cost of the eight months' working, and think it more reliable to give later details now we are in fair wor'king order, as being more accurate.

TABLE *showing the Working Cost for several Weeks during April and May, which is the Period of Small Demand for Lighting, excepting Whit-week, when, being Holiday Time, a Large Increase of Output is requisite here.*

	—		—		Reserve Full Hourly Capacity.	
	No. 1 Week.	Units.	No. 2 Week.	Units.	No. 3 Week.	Units.
Output		2793	Output	2424	Output	4063
	Per Cent.	Units.	Per Cent.	Units.	Per Cent.	Units.
Estimated loss in mains	16·4 =	460	18·9 =	460	13·5 =	550
Estimated loss in transformers	19·3 =	540	22·2 =	540	15·7 =	639
Used at works	3·7 =	106	4·4 =	108	2·6 =	109
Loss.	39·4 =	1106 1106	45·5 =	1108 1108	31·8 =	1298 1298
Accounted	60·6	1687	54·5	1316	68·2	2765
Estimated Revenue—		Units.		Units.		Units.
Metered incandescent		806	Incandescent	481	Incandescent	1829
Arcs 54 / " 827		881	Arcs 122·5 / " 713·0	835	Arcs 277 / " 659	936
Total		1687	Total	1316	Total.	2765
Coals Used—	T. C.		T. C.		T. C.	
	29 5 = 38·8 lbs. per unit sold		29 5 = 49·8 lbs. per unit sold.		31 12 = 32·6 lbs. per unit sold.	
Working Costs—		Per Unit Sold.		Per Unit Sold.		Per Unit Sold.
Coal	£13 9 9	1·8d.	£14 15 3	2·6d.	£14 16 9	1·3d.
Oil and engine stores	3 8 6	0·4	4 5 3	0·8	3 19 4	0·3
Water	2 19 6	0·4	2 17 0	0·5	3 12 0	0·3
Engineer	5 0 0	0·7	5 0 0	0·9	5 0 0	0·4
Electrician	6 0 0	0·8	5 13 6	1·0	5 12 6	0·4
Wages	10 5 7	1·4	10 2 7	1·8	11 3 3	0·9
Repairs and maintnce.	—		—		—	
Works cost	£41 3 4	5·8d.	£42 13 7	7·7d.	£44 3 10	3·8d.
Rates and taxes	1 12 0	0·2	1 12 0	0·2	1 12 0	0·1
Insurance	0 2 6	—	0 2 6	0·01	0 2 6	—
Office, lab., and gen. expenses	4 12 0	0·6	4 12 0	0·8	4 12 0	0·4
Int. & sinking fund	31 0 0	4·4	31 0 0	5·6	31 0 0	2·6
Total costs	£78 9 10	11·1d.	£80 0 0	14·5d.	£81 10 4	7·0d

From these working costs, it is clear, in comparing week No. 3 with Nos. 1 and 2, that increased output for the heavy week caused decreased cost; and the net result for the year depends on the total output the plant is required to supply. It would require an average weekly output of 4000 units, or 208,000 units per annum, to enable the works to sell electricity at 7d. per unit, which is the cost for week No. 3, when the whole plant was employed in producing 4000 units. The amount earned at the prices charged, I think, need not concern you; as the cost price is the datum which ultimately fixes the commercial value in comparison with that of gas.

Having placed before you the result of the working, it remains to be seen what has been the effect on the gas consumption during the period when 78,200 units of electricity were made, or a sale of about 58,000 units; being the equivalent of 5,800,000 cubic feet of gas. Well, during this period there were sold 180 million cubic feet of gas, as against 150 millions the previous year, or an increase of about 30 millions; our increase being five times the sale of electricity sold during the same period. To say that the effect was *nil*, is true in one respect only; for the output of gas has increased—owing partly to the addition of 300 new consumers, and partly to the more general use of gas. Had there been no electricity works, I think we should have had about another million cubic feet of gas sold. Taking 30 of the largest consumers of electricity, and comparing their accounts with the corresponding March quarter of 1893, we arrive at the relative effect on old consumers they take up:—

	Cubic Ft. of Gas.	Electricity.
Thirty consumers used—		
March quarter, 1893 . . .	2,936,000 at 2s. 6d. = £366	— £366
" " 1894 . . .	2,360,000 at 2s. 6d. = 295	£396 691
Less used . . .	576,000 . . Less £72	

So that for the £72 worth less gas used, they took £396 worth of electricity; making the total lighting account £691, against £366—being an increase of £325 for the quarter in their accounts.

To summarize, it is evident that, wherever electricity is used, less gas is burnt; and of the new customers hereafter it will take a share thereof. Electricity undoubtedly being a good light for business purposes, where its principal consumption lies, increased demand will continue until what is termed the "saturation" of the district is reached. The precise amount of this, one can hardly foresee; and I think there is undoubtedly room for both systems in most towns—the extent varying with the peculiarities of each. Hereafter, with a dual supply in operation, the gas industry will have to be satisfied with less than the whole loaf, so to speak—a slice being taken off by electricity; so that the general effect will be that a gas company will be relieved to some extent of that great increase which has yearly taken place in gas consumption.

Further Discovery of Cannel in Flintshire.—The boring operations which have been conducted at Leeswood by Mr. J. Hopwood, of Mold, have been attended with success. On the last day of the past month, the men came upon a seam of the famous Leeswood cannel. We learn that it consists of both "smooth" and "curly" kinds; and above it some 62 yards are in the well-known "main" coal, 7 feet in thickness.

Professor Dewar on Phosphorescence.—At a recent meeting of the Chemical Society, at the Royal Institution, Professor Dewar gave an account of the researches he has lately been carrying out in connection with the behaviour of substances exposed to light at a temperature of 180° below zero. In the course of these, he found that the apparatus with which he was working was phosphorescing brightly; and he was thus induced to study phosphorescence itself at low temperatures. Naturally the question presented itself of the relation of phosphorescence to structure. The Professor therefore experimented with various definite organic compounds. A hydrocarbon like paraffin was feebly phosphorescent at ordinary temperatures; at low ones, it was brilliantly so. Many of the complex compounds known as ketones were exceedingly luminous—acetophenone, for instance. One of the most beautiful phosphorescing bodies was the complex salt the platino-cyanide of ammonium, which shone with a splendid green light. Professor Dewar's experiments led him to the general conclusion that the more complex a body is in structure, the more like is it to phosphoresce, perhaps because, in some way, its structure enables it to take up the light-vibrations with more facility. The capability of oxygen for phosphorescing is another very curious fact. In the gaseous state, it can be made to glow if exposed to an electric spark while rushing into a large vacuum tube. This property is shared by its compounds, but is not possessed by hydrogen or any other gas.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 103.)

THAT the Stock Markets should have been very quiet during the past week need occasion no surprise. When business is flat and unprofitable, and the City is as hot as an oven, the counter-attractions of the course, the field, and the river are more than ever potent; and members congregated at Newmarket, Lord's, and Henley rather than in Capel Court. Taken all round, the markets were fairly firm, in spite of neglect and of some disquieting influences. One disagreeable incident was a difficulty in the adjustment of the last settlement, which proved fatal in one instance, though it was not a heavy casualty. The Scotch strike did not exercise so much pressure as might have been expected; but that which is now raging in the United States was a serious affair, though its worst incidents were too late to affect matters much before the close. The gilt-edged division, meanwhile, are pushing steadily up, and are likely to continue doing so, all the more as confidence is shaken, and the market is overloaded with money. Gas has been more active, though business has been almost entirely confined to the issues of the big undertakings. The demand seems to be growing, and the supply to be quite inadequate; and considerable advances have been made in many quotations. Conspicuous among these are the Metropolitan Companies. Gaslight "A" was very brisk every day, and rose 3; the best price of the week being 245 on Thursday. None of the debenture or preference stocks changed hands; but the 7 per cent. "H" was freely dealt in. South Metropolitans were again in great demand; and every issue, both capital and loan, readily fetched higher figures. Commercials participated in the general advance; and both stocks are quoted at an advance. Scarcely anything was done in the Suburbans and Provincials; and quotations did not move. Business among the Continentals was only moderate; but prices were good, and Imperial made a nice recovery—the last mark being 220¼. None of the rest showed any disposition to move; and the old figures held good. Transactions in the Water Companies were fairly brisk; and many issues rose in value, while others might well have been included in the advance.

The daily operations were: Gas was buoyant and busy on the opening day, and excellent prices were realized everywhere. South Metropolitan debentures rose 3; Imperial Continental, 1. The transactions on Tuesday were mainly in Gaslight "A," at improved figures; but the quotation did not move. Wednesday was decidedly quieter; but many advances in price were made. Gaslight "A" rose 3; South Metropolitan "A," 2; "B," 2; and "C," 2½; Commercial old, 3; and the new, 2. Imperial Continental rose 2. Chelsea Water gained 2; and Lambeth 7½ per cents., 3. On Thursday the recent advances were well maintained, but not pushed further. East London Water debenture advanced 2. Friday was a fairly active day; and fine prices were the rule all round. In Water, New River rose 3; and Southwark, 2. On Saturday, South Metropolitan "C" was the most active stock; and it improved 2 more.

ELECTRIC LIGHTING MEMORANDA.

The Edison and Swan Interests—The Working of Isolated Electric Light Plants—The Cost of Gas and of Private Electric Lighting.

THE final steps required by the Joint-Stock Companies Acts having been duly taken, the whole of the Edison and Swan interest in the United Kingdom is now vested in a single proprietary, and consequently, as the Chairman (Mr. J. S. Forbes) says, the Company are enabled to present a united front to all their enemies. It remains to be seen how the Company will fare now that the patent period is over and the era of unrestricted competition has definitely set in. Major Flood Page, the Deputy-Chairman, has told the proprietors that every single Director and every official connected with the management of the organization agrees in holding that, if the undertaking was to continue its successful career, the fusion now consummated was necessary. This may be easily believed; but, notwithstanding the advantages of union, the Edison and Swan concern will probably have as much as it can do to hold its business against the inroad of cheap lamps, not all of them of foreign make. The stress of competition in the lamp trade is intensified rather than relieved by the conspiracy of silence respecting the actual performances of these articles which is maintained by electricians. All the years of the Edison and Swan monopoly, it was the policy of the Company to call a lamp a lamp, and give no other information respecting its capabilities besides the statement of its nominal candle power at the rated voltage. And scientific gentlemen, when making comparisons of electric and other lamps, always treated a 16-candle lamp as a source of light of 16-candle power. Yet it is pretty well known now that this is misleading; and certain cheap makes of incandescent electric lamps, if not good for much else, are capital instructors of this order of facts. The question that really governs the lamp trade at present is not so much the initial cost of a 16-candle lamp, or a lamp of any other nominal power at the commence-

ment of its service, as the difference between the duty of various makes of lamp at (say) from half-way to the end of their ordinary life. If the Edison and Swan lamps can be relied upon to come out best under this comparative test, the business of the Company will remain, although their patents have gone.

A statement was recently published in *Engineering* respecting the cost of private electric lighting, upon data supplied by Mr. Thomas Hanning. Our contemporary remarks that this is a question of much interest to owners of large establishments, who often wish to ask electrical engineers whether it is more economical to lay down private lighting plant of their own, or buy energy from a central supply station. It is admitted that the question is difficult to answer, seeing that the reply must be founded upon assumptions, many of which are more or less hypothetical. For instance, the apparent cost of working a private installation depends greatly upon the system of book-keeping adopted. One accountant will charge against the plant every possible item he can think of; while another will take no account of any expense beyond the bare cost of running the extra machinery. It is pointed out, however, that the chief governing condition in this matter is the load factor of the plant. Electric energy can be generated at a fraction of a penny per unit for working expenses, if the machinery is constantly worked at full power; whereas a central station charges from 4½d. to 8d. per unit. As the most favourable condition is never realized in practice, the consideration of what will be the load factor in any particular case decides, to a very great extent, what will be the cost of the supply, and consequently determines whether it will be preferable to produce or to buy it. In Mr. Hanning's examples, this point is exceedingly well shown, for he gives particulars of the cost of working three isolated electric lighting plants, in use respectively or 3500, 1000, and 750 hours per annum; the cost of the unit in the respective cases being 1·4d., 3·75d., and 3·9d. In the first example, the plant must have run all the hours of darkness throughout the year, except Sundays, and therefore had practically the largest load factor possible in ordinary circumstances. It lighted a flour-mill which worked night and day for a total cost of £367 10s. for the year, and was a steam-power plant. The average cost per lamp-hour was 0·084d. Next comes a gas-engine plant, lighting warehouses; the charge for gas being 1s. 10d. per 1000 cubic feet. About 250 lamps are in use at a time, and there are accumulators for maintaining 100 lamps. The total cost per annum was £250, and that of the lamp-hour 0·234d. The third example is also a gas-driven plant, lighting retail stores, with a full load of 300 lamps for the hours of lighting. The gas cost 1s. 7·8d. net per 1000 cubic feet; and the total charge was £230 per annum, or 0·244d. per lamp-hour. These figures, it must be admitted, are very remarkable.

In the course of the statement of Mr. Hanning, which forms the subject of the preceding paragraph, there occurs a peculiarly interesting calculation of the consumption of gas in cubic feet per lamp-hour. It is computed that the highest duty of the machinery works out to 7·70 lamps, kept alight, it may be taken, at full power, for every indicated horse power developed by the plant. At this rate, the lamps took 63·1 watts each, which would bear out the assumption that they were developing their full illuminating power. Now the consumption of gas by the engine at this time was after the rate of 2·56 cubic feet per lamp-hour—that is to say, to develop an illuminating power of 16 candles by means of electricity. This lighting duty, be it observed, is far above what would have been derived from burning the gas directly by means of flat-flame or even of Argand burners, assuming the gas in question to have been of ordinary quality. At the same time, either recuperative or incandescent burners would do far better duty than the electric lamps. Mr. Hanning is very fair in the comparison he makes between the cost of gas and electric lighting. He takes 100 cubic feet of gas as equivalent to a unit of electricity when supplying incandescent lamps; showing that, with gas at 1s. 8d. per 1000 cubic feet, the cost of the gas unit would be 2d., to which is to be added a small charge due to interest and depreciation on gas-fittings, the rent of meter, &c. Hence even the steam-power plant running all night does not work out so very much below the cost of cheap gas, especially if the expense of boilers and stoking, which Mr. Hanning does not provide for, were included in the cost of the former. And both the gas-power plants compare unfavourably, in the matter of ultimate expense, with common gas lighting.

A Free Laboratory at the Royal Institution.—The Royal Institution is the recipient of a munificent gift from Mr. Ludwig Mond, F.R.S., who has purchased No. 20, Albemarle Street, a large freehold house adjoining the present premises of the Institution—and has made arrangements for its conversion into a completely equipped physico-chemical research laboratory, which is to be presented to the Institution. Mr. Mond has also provided funds for the maintenance of the building, and for paying the salaries and incidental expenses of the scientific staff under whose control it will be placed. The laboratory will be free to all persons, without distinction of sex or nationality, who may desire to work there, and at the same time are, in the opinion of the Committee, qualified to undertake original scientific work. Mr. Mond has suggested that the laboratory should be known as the "Davy-Faraday Research Laboratory."

THE REPORT OF THE LABOUR COMMISSION.

Continuing our notice (commenced last week) of the above report, we have to deal with the important section devoted to a consideration of the existing methods of settling industrial disputes. These disputes are divided into two classes, and they are said to be settled, either before or after a strike or a lock-out, in one of the following ways: (1) By arbitration, which is defined as the settlement by one or more presumably impartial persons of an issue on which the parties have failed to agree; (2) by conciliation, which is the coming together of the parties for the discussion of questions with a view to amicable settlement; or (3) by mediation, which means the exercise of good offices by outside agency, with a view to avert an impending rupture between the parties, or, if the rupture has taken place, to bring them together again as soon as possible, without itself acting as arbitrator or making an award. Instances are given of the operation of these methods; and the lack of effective means of enforcing awards is noticed and commented upon. It is recognized that both employers and employed have a desire for some improved and more pacific methods of dealing with disputes; but the ideas of both parties as to what such modes should be are very vague and conflicting.

The nature of ordinary commercial agreements, and the means in use for enforcing them, are glanced at; and the question of bringing agreements between employers and large bodies of workmen under some similar legal system is discussed. It may be conveniently mentioned here that a "Memorandum," prepared for the Commission by Sir Frederick Pollock, shows the existing state of the statutory law with reference to arbitration in trade disputes, and is printed as Appendix III. to the report. It is certainly surprising to learn, upon this high authority, that employers and workpeople can actually, whenever they think fit, create, or adopt by agreement, a special tribunal, whose decisions will be binding in all trade disputes, and enforceable under the special powers of an Act of George the Fourth. Yet this machinery has seldom or never been put in operation; and its very existence was unknown, except to legal experts, before the issue of this report.

The next division of the report deals with the question of the limitation of hours of work by legislation, *apropos*, of course, of our old friend the legal eight-hour day. It is impossible to summarize this part of the report, which is itself a summary, and we must therefore quit the topic with the observation that whoever desires to learn, in the fewest possible words, what there is to be said for and against this idea, will be satisfied by this admirable synopsis.

The first mention of undertakings, such as gas and water works, carried on by local authorities, occurs, somewhat oddly, in the section of the report devoted to the subject of irregularity of employment. After discussing the various aspects of the question of the unemployed, the Commissioners arrive at the proposals of those for whom the only thorough-going remedy, both for irregularity of employment and for dissensions between employers and employed, lies in making an end of the present competitive organization of industry, and substituting for it "a collective" organization, based on public ownership of the means and instruments of production, and the control and management of industrial operations by public authorities. A necessary distinction is drawn between the ultimate aim of those who hold these opinions, and the actual measures advocated by the more cautious among them for present adoption. The Commissioners admit that the realization of the entire Collectivist programme would involve the reconstruction of the whole fabric of political, social, and private life in this country; and they declare that no practical purpose could be served by their attempting to discuss anything of the kind. But so far as the immediate programme of the Collectivists is confined to a tentative extension of State and Municipal activity in fields of industry now wholly or partially occupied by private enterprise, they are willing to consider it. Socialists, of course, regard any step of the kind just mentioned with favour, as constituting an advance in the direction of their ideal; but the report very wisely remarks that others who by no means believe in the Socialist ideal may nevertheless hold that State and Municipal employment of labour and control of industry may be usefully carried further than as at present, not only with advantage to the community, but also for the sake of improving the circumstances of the labouring population. This latter consideration opens up a new department of politics. Such industrial undertakings as are now carried on by central departments or municipal authorities have hitherto been entered upon because it appeared, on general grounds, expedient that the work should be done in this way. "The manufacture of gas and the supply of water are now undertaken by a good many municipalities; but, apart from this, they have not hitherto employed much labour of the ordinary industrial kind, as distinguished from the labour involved in the maintenance of markets, parks, and public institutions, or that employed on roads, pavements, and sewers." This employment of labour by local authorities has not been directed in the interest of the labourers. There is no evidence to show that the workpeople employed by municipalities are better off than those in the service of private employers. Consequently, the extension of public employment for the benefit of the working classes must be advocated by the

"Progressists," not so much from experience of the way in which public authorities have acted as employers of labour in the past, as from anticipation of what they may be inclined, or compelled by the electors, to do in future. Five points of argument for and against this proposal are set forth in the report. This is a splendid piece of work; and it may be warmly commended to the study of all those who desire information as to the Collectivist "case" and the objections to it.

It is contended, on behalf of the general policy of extending the sphere of public employment: (1) That public authorities, depending for their position on a popular vote, will be largely responsible to the working classes, and the result will be better treatment of the workmen employed by them; (2) that, if undertakings were brought under the control of public authorities, it would be more possible to avoid trade conflicts; (3) that the consolidation of rival establishments in the hands of one authority would extinguish the mischief of cut-throat competition; (4) that the enterprises—most of them in the nature of local monopolies—which would first be brought more generally under public control, such as gas and water works, tramways, and docks, employ chiefly unskilled labour, which is precisely the kind of labour that cannot protect itself, and falls most readily into pauperism; and (5) that the extension of employment by public authorities would be economically advantageous, owing to the cheapness of capital secured on public rates, and to the saving of such expenses as those of company promotion, litigation, &c. Against these pleas it is urged *seriatim:* (1) That a large extension of direct employment by the State or by Municipalities would tend to introduce into national and local politics a dangerous element of corruption. It is difficult for public authorities, whose position depends on the result of a popular vote, to combine with success the parts of direct employers of labour and custodians of the public purse. The "more just and impartial view of the claims of labour," expected to be taken by employers who are under no necessity of making a profit, might too often come to mean, in practice, the taxing of the community for the benefit of the particular classes of workmen who happened to be in the public service. (2) It may be conceded that strikes would not be likely to be very frequent in public establishments in which the conditions of employment were distinctly better than those prevailing in private establishments. (3) Monopoly, either public or private, extinguishes the evils of competition; but with them its benefits also. Public employment is not generally more regular than that of private firms which have similar work to do. For instance, it is about equally regular in the case of gas-works, water-works, tramways, and railways. (4) The argument that local authorities, in taking over the management of gas-works, &c., would be enabled to provide more employment for just the class that stands most in need of help, seems to overlook the fact that the more capable among unskilled labourers have, as a rule, little difficulty in finding employment. "The class of men who could be advantageously employed as gas stokers, and in connection with water-works and tramways, are probably able to look after themselves fairly well. . . . . It would appear that the extension of public employment for the sake of the employed has, as its natural complement, the right of every citizen to demand employment from the public at wages sufficient for a maintenance. But to concede this right would be to place the national welfare in jeopardy." (5) Lastly, the allegation that employment by public authorities in fields now occupied by private enterprise would be economically advantageous, is strenuously denied, and the contrary maintained. Though money may be borrowed upon public securities at a lower rate of interest, a definite charge must be borne for the redemption of capital, or such changes as the substitution of electricity for gas, or a transfer in the current of trade, might leave a community saddled with a debt without a corresponding income-producing asset. Moreover, it is contended that the credit of the State and of local communities is good only so long as their debts are small relatively to their resources, and that it would suffer materially if the policy indicated were carried out. It is further contended that the loss due to wasteful forms of competition is not to be compared to the wastefulness of the inertia of Government Departments, when grown a little old and escaped from the prying eye of public criticism. It is not denied that public authorities can utilize the progress made by others. But they soon fall behind; and, by diminishing the area from which inventions can come, they retard progress in private industry. It is admitted that some of these considerations apply with less force to the management by public authorities of a class of undertakings like gas and water works, &c., in which industrial procedure is simple and not much machinery is required, and which naturally lend themselves to local monopoly, than to the management by such authorities of skilled work involving the use of elaborate machinery, and exposed to the competition and vicissitudes of the open market at home and abroad.

The remaining portions of the report deal with such matters as a Government Labour Department and labour statistics; the employment of women; and especially dangerous and unhealthy processes in certain employments. We shall have to consider in another article the recommendations with which the report concludes, and the observations of some of the Commissioners thereupon.

NOTES.

The Force of Gusts in Gales.

At a recent meeting of the Royal Meteorological Society, Mr. R. H. Curtis read a paper describing some characteristic features of gales and strong winds. After calling attention to the unsatisfactory state of anemometry, and describing the "bridled" anemometer at Holyhead, which has been devised to register the force of gusts, Mr. Curtis stated that the greatest force of a gust that has come under his notice was registered in December, 1891, and amounted to a rate of 111 miles per hour, which with the old factor would be equivalent to a computed rate of about 160 miles per hour. Gusts at a rate of from 90 to 100 miles per hour have many times been recorded; but the usual limit for gusts may be taken at 80 miles per hour, which on the old scale would be equivalent to about 120 miles per hour. Gales and strong winds differ widely in character; and as a result of prolonged study of their general features, as recorded by the bridled anemometer, Mr. Curtis has been able to group them into three general classes. Some gales are essentially squally in character; the gusts constituting their main feature. In an average gale, the ordinary gusts follow each other at intervals of about 10 to 20 seconds, while the extreme gusts occur about every minute. There is another class of gales in which the wind pressure is tolerably steady. Mr. Curtis's third class of gales include those storms which appear to be made up of two series of rapidly succeeding squalls—the one series at a comparatively low rate of velocity, and the other at a much higher one; the wind-force shifting rapidly and very frequently from one series to the other. Mr. Curtis has also detected in his anemometer records, indications of prolonged pulsations of the wind-force, recurring again and again with more or less regularity at intervals varying in different cases from twenty minutes to an hour.

The Effect of Temperature upon the Strength of Metals.

Herr Rudeloff has conducted a series of experiments to determine the effect of alterations of temperature upon the tensile strength of different metals in common use for engineering purposes; comprising wrought iron, mild steel, copper, delta metal, and manganese bronze. The temperatures adopted were the ordinary temperature of the room, 100° C. obtained by means of a steam-jacket, 200° C. by means of naphthalene vapour, 300° C. by naphthylamine vapour, and 400° C. by a metal bath. The following are the chief conclusions drawn from these tests; regard being had to the circumstance that they apply primarily to the particular specimens tested, and are not necessarily to be accepted without modification for all the varieties of metals examined generally. Wrought iron and steel show a similarity in losing elongation up to 150° C., and a corresponding increase in technical strength up to 250° C.; indicating that the injurious influence of increase of temperature up to the latter point on the working capabilities of the metal is as true for wrought iron as it is generally known to be for mild steel. Above 300° C., wrought iron exhibits a decrease in tensile strength with increased elongation; whereas mild steel, though also suffering diminution of strength, also suffers in elongation. It follows from this that, while the temperature below which wrought iron is liable to injury in working may be set at 300° C., for mild steel a higher limit must be adopted.

The Motion of Gas in Pipes.

It is remarked by Herr K. W. Jurisch that when a gas passes through a tube, the velocity of its motion at the axis is necessarily greater than it is at the periphery, on account of the friction of the gas against the sides of the pipe. It is usual to assume that the mean velocity of the flow of gas in a round pipe is the same as that at a point situated at a distance from the side equal to one-third of the radius. Herr Jurisch has made a number of experiments which go to show that this assumption is only approximately correct; the limits of error being found to range from -3 to $+30$ per cent. So that when a greater degreee of accuracy is requisite in a determination of the kind, the velocities of flow at various distances from the side must be measured, and the average value deduced therefrom. Thus in the case of the gases passing to a Gay-Lussac tower through a circular leaden pipe of 10·76 inches radius, the velocities in feet per second at different distances from the side, measured by means of a Fletcher's anemometer, were as follows: At 1 inch, 4·038; at 2 inches, 4·514; at 3 inches, 4·945; at 4 inches, 5·342; at 5 inches, 5·710; at 7 inches, 6·056; and at 8 inches, 6·056. The retardation due to skin friction is here very well exhibited. The mean velocity calculated over the whole cross-sectional area of the pipe is 4·968 feet per second, whereas the velocity at one-third of the radius is 5·116 feet per second, or 103·88 per cent. of the true value. Several other similar series of observations gave values, at one-third the radius, varying between 96·92 and 132·23 per cent. of the true average velocity. Analogous results were obtained from much larger flues conveying hot air and gases. In one case—that of a tunnel of 52·5 inches radius—the velocity at 1 inch from the side was 2·019 feet per second, while that at 42 inches from it was 6·384 feet per second. Here the true average velocity was 3·434 feet per second; while the observation taken at one-third the radius gave a velocity of 4 feet per second, which is 116·5 per cent.

TECHNICAL RECORD.

WESTERN (U.S.A.) GAS ASSOCIATION.

The Annual Meeting at Cleveland.

(*Continued from Vol.* LXIII., *p.* 1235.)

Mr. S. M. Highlands, of Clinton (Iowa), read a paper entitled, "Three Years in a Country Gas-Works." On taking the management of the Clinton Gas-Works, three years ago, the author found an ordinary "6-inch" coal-gas plant, supplying 6½ million cubic feet of gas per annum, at prices ranging from 8s. 4d. to 10s. 6d. per 1000 cubic feet. The price was at once reduced to 7s. 4d. for illuminating purposes and 5s. 3d. for day uses; and, disregarding the old adage that "money is made or lost in the retort-house," he set to work to try and sell gas, believing this to be a wiser plan than devoting the best part of his time to small economies in production. At that time there were 235 meters fixed, and not one stove; but, by adopting a liberal policy in laying services and internal pipes free, and supplying stoves at cost price, he placed 185 stoves and added 392 meters for lighting, during the summer of 1891. On this work he spent £800; and he thought the results showed it to be a wise expenditure. Then he tackled the electric light by offering to supply the 53 customers who used that method of lighting, for twelve months, at half the price they were paying. Of these, 45 at once accepted; and the result was that the electric light was "shut up." The contract customers were metered; and during the year they used nearly 3 millions, for which the average price received worked out to 3s. 1d. per 1000 cubic feet. At the end of 1891, he bought up the electric light plant, and reduced the price 25 per cent. This made the rate per arc lamp of 2000-candle power nominal, 25s. per month for lights out at nine, or 33s. 4d. for lights continued to ten o'clock. The gas contract customers were offered the privilege of surrendering their contracts, and returning to the arc light; but none of them accepted. Since then about half had returned to electricity. Where customers would not take gas for lighting, but only for a stove, he fixed a light near the stove, and allowed it to pass at the stove price. This was a successful way of introducing gas in other parts of the house. He was very particular with regard to courteous treatment of the customers, and to afford the promptest attention to all complaints. In reconstructing and extending both gas and electric lighting plant, everything was provided of the best kind; and for the last two years he had charged a fair price for all fitting work. His consumption of gas had now increased to upwards of 20 millions per annum; and he had 940 customers. But the electric lighting business had only increased from 50 to 65 arcs, and from 800 to 1200 incandescent lamps since he had it. He had, however, secured the street lighting, and the supply of an electric railway with electricity; so the gross business of the electric plant was larger than that of the gas plant. In 1891 he also extended his mains to Lyons, a neighbouring town of 7000 inhabitants, where there was a municipal electric plant, but no gas. With gas at 7s. 3d. per 1000 cubic feet, he tried to compete with arc lights at 23s. per month; but without much success. Last year he put in 50 Welsbach burners, and they led to the entire displacement of the arc lights; but at the same time they reduced the consumption of gas so much that he thought he would be glad to have a few electric lights back if he could get rid of them. At Clinton, he preferred furnishing arc lights to Welsbachs.

Discussion being invited, questions were asked as to how other customers regarded the special contracts. Mr. Butterworth said it was a risky thing to pipe houses free. If an opposition company or a natural gas supply came along in a year or two, no consideration would be shown, but the property owners would use the piping for the other supply. Mr. Douglas said he had no doubt it paid to look after the sale of gas; but he thought it would also pay to look after the works. Mr. Holmes said that at one time he was managing an electric light concern with 300 customers, and the gas company tried the same tactics as those mentioned in the paper. He retaliated by canvassing all the customers of the gas company, and offering to furnish electricity at similar rates. Mr. W. L. Brown said the lesson to be learned from the paper was that everyone should carefully study the entire situation, and then follow out the best line he could work upon. Mr. Somerville remarked that for years he had advocated full control of the fittings by gas companies; and the paper showed the result of adopting this course. Mr. Highlands, in replying, said he had followed a free course with the special contracts. He commenced or discontinued them as he chose, and he had not found that any bad feeling resulted. Of course, he did not neglect the works.

Mr. I. C. Copley, of Aurora (Ill.), followed with a paper on "How to Make Small Electric Plants Pay." He said he was convinced that it was impossible to operate an independent electric lighting plant at a fair profit, in cities of less than 25,000 population situated in the Western district. Local conditions and circumstances varied widely; and so he would not do more than lay down a few abstract facts, which showed that money could be made by joining the gas and electric lighting plant. The abnormal development of electric lighting which had been a feature of the past few years was due to the efforts of the persistent supply man, to the ignorance of investors, and to the love of the American public for novelty. But the public were now satisfied that the new light was neither so satisfactory nor so cheap as gas; and the business was now rapidly coming round to ordinary commercial lines. A great advantage of the combination of gas and electricity under one management would be the saving of the money now spent in competition. In a small town, the two concerns could be worked together with a saving in running and establishment expenses right through. The work of arc lighting was, in some respects, out of competition with gas; but the incandescent lights came directly into the field, and there was an inclination not merely to use them for their own merits, but also to support competition. Under one control, each agent would be sold on its merits alone; so he contended that, in these circumstances, there would be a better *pro ratâ* output of gas. The electric man was no friend to the use of gas for fuel, as he naturally preferred to keep the gas out of the house altogether; and in some districts he had been so successful that many of the houses were not piped for gas at all. So there were several reasons why it was desirable, as regards gas interests, that the electric supply should be under the same management; and the author concluded by referring to actual examples in support of his argument.

After a short discussion on the paper, Mr. Ramsdell, on behalf of the Special Committee on Federation, said that progress was being made with the matter, but they were not yet in a position to issue a report. He also gave some information as to the lines on which the Committee were working.

Mr. J. W. Stratton, of Valparaiso (Ind.), then read a paper on the advantages of oil-gas works supplying high-quality gas for small towns of 4000 to 6000 inhabitants. He claimed that the capital necessary for the supply of 60 to 80 candle gas was less than half that required for the ordinary coal or water gas plant, and the whole of the distributing appliances could be proportionately smaller. The labour was simpler and cheaper; and he recommended naphtha of 63° to 68° Beaumé as the gas material, while any kind of fuel could be used. An oil-storeage tank, holding at least 8000 gallons, was required; and the retorts were made of wrought iron or steel tube, 6 to 8 inches in diameter, and worked in pairs as in the Pintsch process; the oil passing into the top retort, and the bottom one acting as the fixing chamber. Three pairs were placed in each furnace; and the top would last from 12 to 18 months, but the bottom retort only about one-third of that time. Dry scrubbers packed with perforated iron diaphragms were all the purifying apparatus required, as there was no sulphur in the gas. The gas was more permanent under changes of temperature than ordinary coal gas; and it was also less poisonous.

(*To be continued.*)

Photographs of Flames.—At a recent meeting of the Physical Society, Captain Abney exhibited his photographs of flames. Before doing so, he demonstrated that a candle flame contains solid particles by passing a beam of polarized light through it—the track of the beam through the flame being clearly seen in one direction, while in a direction at right angles it was practically invisible. The same thing was also shown by passing the light through a turbid liquid. Photographs of Argand and candle flames, with pencils of sunlight and electric light passing through, were also exhibited, revealing similar phenomena. Several series of photographs of flames of candles and various forms of gas-burners, taken with diminishing exposures, were then shown, in order to illustrate the different luminosities at various parts of the flame. From the photographs, the author concluded that, when used with a slit as a photometric standard, the Argand burner was unsuitable, for portions of different luminosity came into view when the slit was approached or receded from. The fishtail burner was, he said, better in this respect.

The Flash-Point of Mineral Oils.—An interesting series of experiments recently took place at the works of the Linlithgow Oil Company, for the purpose of ascertaining the relative flash-points of American, Russian, and Scotch mineral oils, and the effects produced when lamps are broken or upset. They were conducted by Mr. F. Bishop, the Company's Chemist. The first experiment was made with Professor Abel's regulation test apparatus, in which the oil is heated in an enclosed vessel 2 inches in diameter until the flash-point is reached. The sample tested was the American oil chiefly used in this country. It lighted at a temperature of 76°, or 3° above the Government standard. To show the arbitrary character of the regulation test, a sample of the same oil was placed in a vessel 9 inches in diameter, of exactly similar construction to that of Professor Abel, and in this case the flash-point fell to 69°. Next a popular Russian oil was tested, and was found to flash with the Abel apparatus at 84°; and in the extended experiment, when the larger body of oil was used, at 79°. Subsequently, the ordinary No. 1 oil of the Company was tested by the regulation apparatus; and it did not flash until a temperature of 116° was reached. Then a number of duplex metal lamps, charged with Scotch, American, and Russian oil, which had been burning for some time, were shown. Experiments were also carried out to demonstrate the greater inflammability of the foreign, as compared with the Scotch oil.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

The Profit-Sharing System.

SIR,—I again thank you for naming the difficulties that with some men bar the way to the adoption of profit-sharing; and once more I ask leave to reply to those objectors.

If profit-sharing is said to be equivalent to an addition to wages, at any rate it is only so nominally, as you point out. There is, however, another side to that question. We get an equivalent in the absolute security which the yearly agreement gives against a strike; and for this I may remind your readers that at Glasgow and Coventry, I believe, and possibly elsewhere, 1s. a week, or £2 12s. a year, is given by the Corporations as a condition of signing an agreement such as ours—in fact, practically copied from it. This is two-thirds on the way, in the item of expense, towards profit-sharing, without its great advantage of creating identity of interest between employers and employed.

Then you tell me that it is said we should have done just as well if we had not gone in for profit-sharing. I doubt it; for the fact that the Union men struck against profit-sharing turned public opinion entirely against them. The result, so far as the issue of the strike was concerned, would, I admit, have been the same; but our position afterwards would have been vastly different. We should have been masters of our business, as we now are; but we should not have made our men our friends, as we have done. Without profit-sharing, our men would have been ready, as soon as they had the opportunity, to turn against us; but with it, this is inconceivable.

GEORGE LIVESEY.

Reigate, July 6, 1894.

Mr. Newbigging's Gas Institute Paper.

SIR,—Probably I read Mr. Hunt's address at the time it was delivered in 1892, and also his letter to the JOURNAL later; but, if I did, they had passed from my mind. It is no new thing to advocate the supply of gas of low photometrical power for purposes other than lighting. The late Sir William Siemens did so, many years ago, as your readers will remember.

I am glad that Mr. Hunt is in favour of a general reduction of the standard. It may be allowed to me to point out, however, that his reason for advocating the reduced standard differs fundamentally from mine. Apparently (if I understand him aright) he wishes to see a lower standard, being indifferent to the reduction in the photometrical power, which he assumes to be the same thing as illuminating effect; whereas I desire it because I believe that thereby the lighting value will be increased. Evidently Mr. Hunt has not caught the full drift of my paper. Many men (gas engineers and others) are lacking in the gift of imagination—a sad want, believe me; for the imaginative faculty is needed in him who would grasp the higher problems of gas lighting as well as those of less mundane things. Of course, I see that it is easy here to try a small joke at my expense; but I shall not feel any the worse for it if any one (in spite of this notice) cares to perpetrate that same.

I object to Mr. Hunt's description of gas of low photometrical power as "gas of a low quality." It is equivalent to saying to the consumer: "Here, my friend, this gas is nasty, but it is cheap!" instead of putting it: "This is not only cheaper but better than the other." Describing the gas as of "low *quality*" will not tend to reconcile it to the consumer, who (with all deference to Mr. Hunt) must be convinced, either at first or second hand, before the desired salutary reform in the standard can be accomplished.

THOMAS NEWBIGGING.

Manchester, July 5, 1894.

The Large New Gasholder at East Greenwich.

SIR,—In reply to Mr. Taylor's letter, we beg to say that the remarks contained in ours of the 20th ult., in reference to his statements at the Council meeting, were solely made on the presumed accuracy of the report contained in the local papers and your issue of the 19th ult.; and as the reported statement was in flagrant opposition to the true facts of the case, we felt justified in entering a strong protest. But now that Mr. Taylor has given the true version of his observation—correcting the mis-guiding reports—our object is served, and we withdraw our remarks, which, owing to the erroneous report, we felt called upon to make.

CLAYTON, SON, AND CO., LIMITED.

Hunslet, Leeds, July 5, 1894.

Income-Tax on Dividends.

SIR,—In reply to "Provincial Secretary," whose letter on the above subject appeared in the JOURNAL for the 29th ult., I may say it is his duty to assist individual shareholders in obtaining the return of income-tax to which they are entitled. As the Government have a special form of certificate of payment of tax where the tax has been paid by a company, but not deducted from the dividend, it is clear the shareholder is entitled to a return. Whether the company are within their powers in paying a dividend without deducting the tax is another matter. If it has been legal for them to do so in the past, it will be legal for them to do so in the future, notwithstanding that some shareholders may be entitled to a return of the tax; for, in the instance quoted, the 7d. is not received by the shareholder from the company, but from the Government. It is a payment over which the company have not the slightest influence.

Your correspondent's letter shows him to be of a kindly nature, and desirous of assisting his poorer shareholders; and his real difficulty is his fear of the consequences if he should be held to have paid a dividend in excess of the 10 per cent. allowed by the Gas-Works Clauses Act, 1847. He will find that section 30 says: "The profits. . . . to be divided. . . . shall not exceed the rate of ten pounds in the hundred by the year on the paid-up capital," &c. Section 31 provides that the excess of profits beyond the 10 per cent. shall be invested, until the reserve fund amounts to one-tenth of the nominal capital. Money paid for income-tax cannot, therefore, be invested. The Act cannot regard such money as part of the profits.

The income-tax is paid by the company on the profits, before any division, and not (as with the dividends on Consols) on the amount paid to each shareholder. It is levied on the profits, in the same way as the estate duty proposed in the present Budget, which will be levied on the whole estate before any division, and will not be a charge on, or deduction from, the individual share of each legatee. This difference in the incidence of the estate duty was forcibly explained by the Chancellor of the Exchequer recently in the course of the Budget debate. Further, the profits taxed are not the net profits, for frequently the amount allowed to be written off for repairs, depreciation, &c., is wholly insufficient. Thus is emphasized my contention that the tax is a tax on the company's profits, and not on the shareholders' dividends. To show that this difference is not accidental, I will take another example from the legacy duties. If a testator bequeath a legacy of £1000 to a stranger in blood, free of legacy duty, the duty will amount to £100; but if £1100 were bequeathed, and the legatee were left to pay the duty himself, the duty would amount to £110, and the legatee would receive only £990.

If "Provincial Secretary" still has any doubts, I would recommend him to state them in writing in the form of a letter to the Secretary, Inland Revenue, Somerset House, and leave him to settle it with the shareholders claiming repayment. He may rely upon it that the Inland Revenue Commissioners will not refund more than they are obliged to do. This course may also obtain for him an authoritative decision whether his Company has not been paying a dividend in excess of the prescribed rate.

LL.B. (LOND.).

July 2, 1894.

The Valuation of Gas Appliances for Rating Purposes.

SIR,—At the risk of being classed with those upon whom your strictures fell somewhat heavily last week, I venture to ask for information upon the subject of assessment for rating. I candidly confess that I do not read the JOURNAL through from cover to cover; one of the portions I am most inclined to skip being that in which rating cases and appeals are reported.

The particular point upon which I want information just now is the position which public lamps occupy in making up poor-law assessments. Is the tenant supposed to find the lamps, or are they included in his "take" from the landlord? Is a public lamp (or, for the matter of that, a private lamp) a hereditament? Would not most valuers class a lamp on private property as a tenant's fixture? If the columns and brackets should, by the nature of their attachment to the soil or the buildings, be held to be landlord's property, surely the lanterns and fittings cannot be considered to be other than chattels? I have referred to Mr. Newbigging's small work on "The Valuation of Gas-Works for Assessment," and do not find any reference to lamps. If the tenant provides the lamps, the amount would be added to the "working capital" he has to provide.

Another point upon which information would be very acceptable is that of meters and stoves. Mr. Newbigging, in his book, advises that the receipts for meter-rents should be excluded. The tenant would in that case accept the rents as an adequate return upon his outlay in meters. That rule may very well be adopted where meter-rents are charged; but my Company decided a few years ago to give up charging meter-rents. They also supply cooking and heating stoves at nominal rents. The supply of gas could not be conducted in these days without meters; and the "hypothetical tenant" would have to provide them. He would also, if he wished to maintain the present demand for gas, have to offer the public the same advantages and facilities as they now possess. To do so would entail a considerable expenditure, which I assume should be added to the tenant's "working capital," and a fair rate per cent. be allowed thereon for repairs and renewals. What rates, under such circumstances, have been allowed?

There appears to be a decided tendency on the part of valuers and Assessment Committees to make undertakings such as those supplying gas and water contribute heavily to the rates, and unduly so in proportion to private manufacturing concerns.

HENRY TOBEY.

Malton (Yorks.), July 7, 1894.

Gas Companies and the Gas Appliances Trade.

SIR,—In your current issue, we note Mr. West's letter commenting upon ours in the JOURNAL for the 26th ult., from the contents of which Mr. West judged our intelligence to be incapable of grasping the meaning of his remarks to the members of The Gas Institute on the above subject. While thanking Mr. West for kindly contributing this explanatory communication, we hasten to assure him that, though very welcome as aiding to ventilate the subject, it was quite unnecessary for the object he mentions, inasmuch as his remarks were in plain English, and their meaning by no means obscure. But what he could not, and, even with the aid of Mr. West's letter, still cannot understand is how his prefatory advice, "Do not act upon these suggestions," can in any way be reconciled with his remarks in his address to the Institute, and in his present communication, seeing that the latter actually teems with expressions to the effect that *the companies should sell appliances at a fair profit*, which is the very essence of the proposed arrangement as set forth in our tentative propositions to *The Ironmonger*. These were as follows: (1) The companies to cease selling or hiring altogether. (2) The companies to cease selling, but to continue hiring at rates which would equalize competition with selling. (3) The companies to continue both selling and hiring—the former at the retail list prices, the latter at the altered scale of rates suggested.

On this apparent inconsistency we should be glad to be enlightened; and we only regret that our lack of understanding renders further explanation necessary. At the same time we quote from Mr. West's

address and letter the expressions mentioned in confirmation of our contention: (1) The Northampton Gas Company made cooking and heating appliances, "and all of them were sold to customers in the ordinary way of business at a fair profit." (2) Mr. West "has always refrained from going into severe competition with the trade; but he has endeavoured to sell them fittings, &c., so that they could make a profit." (3) The companies "secure their profits by the sale of gas, coke, gas-stoves, &c.; and the more they can get by selling their residuals and by profits on the sale of gas-fittings and stoves, the cheaper can they supply their consumers with gas." (4) "I know there are at the present time gas undertakings which are letting out stoves at too low a rent to make the stove department self-supporting. I must confess that personally I do not like this system; believing that it is better that each tub should stand on its own bottom." (5) "I hold that the advantages of cooking by gas are so great that, if they were more generally known and understood, a good and fair price could be obtained by the sale or hire of gas appliances." (6) "If conductors of gas undertakings take my advice, they will both sell and let out stoves, so that they will secure a profit and be self-supporting in themselves, on the same lines that the electrical companies are being worked; for it is well known that where any dividend has been paid by electrical companies, it has been principally, if not wholly, derived from the sale of the appliances."

We note that Mr. West is quite in accord with us on other points, in that he deprecates "letting on hire," recommends the companies to act as advisers, lecturers, and exhibitors to the public, to have show-rooms containing all the various appliances, and to show customers how to use gas economically and scientifically—all of which we have suggested as being the proper sphere for the companies. And how are these duties carried out under the present system? The companies do "hire out," but patterns on the market for years, and selected for their durable character, and not merely on their merits as scientific and economical appliances. Novelties are "boycotted" for financial reasons resulting from a policy which creates a loss to the department, and which must be compensated by increasing the price of gas itself. The companies assume to be advisers; but they are not impartial in this respect—novelties being excluded. Advice, if given at all, is tempered by "stock" considerations. The companies are exhibitors to a restricted extent, and also lecturers; but they cannot really educate the consumer, unless they first become acquainted with new inventions and the latest developments, with a view to advising thereon. This they will not do until the present restraining influence of stock considerations has disappeared.

Of Mr. West's remaining remarks, we might quote one or two as follows: (1) The companies are "large traders—buying and selling their commodities like other companies." (2) "It appears that there are some people who think it is a gas company's duty not only to provide profits for their own shareholders, but at the same time to act as philanthropists, and hand over some of their profits to them." (3) "I never found any material difficulty with the ironmongers."

With regard to these remarks, we should be glad to learn (1) What "other companies" buy goods and sell them, at the same price, and yet remain financially sound. We were under the impression that this strange trade procedure was confined to gas companies; but evidently we are wrong. (2) What "profits" is Mr. West alluding to? Apparently it is those from the sale of appliances; but it cannot be this, as no one can surely be longing for that which, as far as gas companies are concerned, is a *minus* quantity. (3) This is not surprising, considering Mr. West never entered into severe competition with the parties mentioned.

In conclusion, we would congratulate Mr. West on the fact that the bent of his individual genius for invention was in the direction of appliances for the use of gas companies only, and that he does not, therefore, labour under the disabilities appertaining to an inventor of appliances for domestic use not favoured by the companies' patronage. At the same time, we are very glad that his policy as regards this appliances trade (which, under the circumstances, we presume agrees with his remarks quoted, and not with his prefaced advice) is in accord with the trade's desires; and we trust it will be adopted by many of his hearers and readers.

HERSEY BROS., LIMITED.

July 6, 1894.

Threatened Litigation as to the Payment for Water Supplied to Castleford.—At the meeting of the Castleford Local Board last Thursday week, a writ was received from the Wakefield Corporation, claiming a sum of £281 for water supplied. The Board had forwarded £62; but the cheque was returned. It was decided to meet the Corporation in Court, on the ground that the water was unfit for consumption.

Gainsborough Water Supply.—At the latter end of last year, the Gainsborough Local Board of Health obtained the sanction of the Local Government Board to a loan of £12,500 for the purpose of carrying out a scheme of water supply in accordance with the designs and estimates of their Engineer, Mr. Jabez Church, M.Inst.C.E. The Board have, however, since considered the risks attached to this scheme, which involved the construction of a heading 25 feet long from the bottom of a well 250 feet deep to their existing boring, which is only 10 inches in diameter in the sandstone; and finding also, on a careful test of this boring, that its capacity was hardly equal to their requirements without tapping it at a greater depth, they have decided to abandon the original scheme, and to substitute a new and independent boring for the well and heading originally contemplated. The scheme now proposed, which has been designed by Mr. Church and approved by the Water Committee of the Local Board, consists of a single boring 1450 feet deep (or 700 feet into the water-bearing sandstone), 18 inches minimum diameter at the bottom, 30 inches diameter for a depth of 300 feet from the surface, having a 20-inch lift-pump suspended in it, worked from a direct-acting compound condensing engine, also a force-pump worked from the tail rod of the low-pressure cylinder. The total capacity of the new plant will be—as in the original scheme—from 50,000 to 60,000 gallons per hour under a maximum total lift of 400 feet. Application is being made to the Local Government Board for sanction to the alteration of the scheme.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Bills:—

Bill read the first time and referred to the Examiners: Cardiff Corporation Bill.

Bills referred to a Select Committee, consisting of Lord Northington (Chairman), the Earl of Malmesbury, the Earl of Rosse, Lord Hatherton, and Lord Lamington; to meet on Tuesday, July 10: East London Water Bill, Southwark and Vauxhall Water Bill, and West Middlesex Water Bill.

Bills reported, with amendments: Hebden Bridge Gas Bill, Preston Gas Bill, Swinton Water Bill, Wakefield Corporation Bill.

Bills read the third time and passed: Gloucester Corporation Bill, Swindon Water Bill.

Bills Royal Assented: Aberdare Local Board Water Bill, Abertillery Local Board (Gas and Water) Bill, Bacup Corporation Water Bill, Bury Corporation Bill, Carshalton and Croydon Gas Bill, Dundee Corporation Bill, Electric Lighting Provisional Orders Bills (Nos. 1 and 2), Edinburgh and Leith Corporations Gas Bill, Falkirk Corporation Gas Bill, Fulwood Local Board Water Bill, Local Government Provisional Order (Gas) Bill, Newcastle and Gateshead Water Bill, Southend Water Bill, South Hants Water Bill, Torquay Gas Bill, Wemyss, &c., Water Provisional Order Bill.

Petitions against the following Bills have been presented:—

East London Water Bill, from the Corporations of London and West Ham and the London County Council.

Southwark and Vauxhall Water Bill, from the Corporation of London, the London County Council, and the Grand Junction and West Middlesex Water Companies.

West Middlesex Water Bill, from the Corporation of London and the London County Council.

The Conservators of the Thames have petitioned against alteration in the Southwark and Vauxhall Water Bill.

HOUSE OF COMMONS.

The following progress has been made with Bills:—

Bill read the first time and referred to the Examiners: Swindon Water Bill.

Bills reported: Electric Lighting Provisional Orders Bills (Nos. 3, 4, and 5), Gas Orders Confirmation Bills (Nos. 1 and 2), Water Orders Confirmation Bill.

Bills read the third time and passed: Electric Lighting Provisional Orders Bills (Nos. 3, 4, and 5), Gas Orders Confirmation Bills (Nos. 1 and 2), Water Orders Confirmation Bill.

A petition for an inquiry into the working of the Metropolitan Gas Companies has been presented from Whitechapel.

HOUSE OF COMMONS COMMITTEE.

(*Before Mr.* JACKSON, *Chairman; Mr.* H. F. PEASE, *Mr.* PAULTON, *and Mr.* ROUND.)

Thursday, May 31.

THAMES CONSERVANCY BILL.

The inquiry into the above-named Bill, the proceedings on which, as far as they specially interested our readers, were reported in the last volume of the JOURNAL, was continued to-day, when a discussion took place upon the financial clauses, and upon the proposals of the Conservators for the allocation of the funds at their disposal between the Upper and Lower Navigations.

Mr. J. V. FITZGERALD, on behalf of the London County Council, inquired what was the proposition of the Conservators with regard to the contributions of the Water Companies. Were they to be allocated to the part of the river above the intakes, or between the Upper and Lower Navigations.

Mr. BAGGALLAY replied that, if the Companies did not make any fresh suggestion, the Conservators intended to keep very much to the present division. Provided the Companies' contributions were applied to works and to the purification of the river above Teddington, this was the extent to which it should be allocated, according to the contention of the Conservators.

Mr. *Gough* was then recalled. He handed in detailed accounts of the moneys received and expended by the Conservators during the year 1892, from which it appeared that the total revenue of the Lower Navigation was £75,850; and the expenditure chargeable against the revenue, £75,256. In the case of the Upper Navigation, the revenue was £17,765; and the expenditure, about £24,000. At present, the whole of the £18,665 received from the Water Companies, with the exception of the £1450 which went to the Conservancy Fund, was spent on the upper portion of the river, above Staines. While it might be possible to carry out the proposal of the Companies that a certain portion of the moneys received from them should be allocated to works and expenses connected with the prevention of pollution above the intakes or down at Molesey, he considered it reasonable that some portion—not a very large one—of the extra £7500 should be allotted to the purification of the river between Staines and Teddington.

Cross-examined by Mr. FITZGERALD: He agreed that, so far as the water supply of London was concerned, the important point for the stopping of pollution was above the Water Companies' intakes. At the same time, it was necessary that the water should be pure throughout the whole flow of the river.

Mr. FITZGERALD: What guarantee have the Companies that the whole of their contributions will be expended in stopping the pollution of the river?

Witness: I do not think that is intended. The whole of the works on the river tend to the improvement of the water supply; and the additional contribution is required for the purpose of enabling the officers of the Conservators to inspect the new district over which the Committee have given the Conservators additional pollution powers.

Cross-examination continued: He should object to the whole of the contributions of the Companies being expended in the salaries of inspecting officers. Part of them would undoubtedly be employed in the prevention of pollution; but he did not think the Conservators should be tied down by absolute allocation. In his opinion, it would be very undesirable to adopt Richmond as the dividing-line between the Upper and Lower Navigations, because, though a lock and bridge with moveable sluices had been erected there, the river between Richmond and Teddington was still tidal, and therefore part of the port of London, just as much as the section of the river between London Bridge and Richmond.

Mr. FITZGERALD: When you proceed to allocate the expenses between the two funds, you will allocate to the Upper Navigation fund a proportion of the establishment expenses, will you not?

Witness: It is possible that may be so; but it must be left to the decision of the Conservators. I cannot decide the question.

And if that is so, I am afraid it will have to come out of the contributions of the Water Companies?—Probably it may.

There is no other fund, is there, out of which it can come?—Yes; there are the barge and pleasure tolls, and registration and other fees.

Just to put one comprehensive question to you, every expense which you cannot otherwise provide for will come out of the contributions of the Water Companies, will it not?—I cannot quite admit that. It will come out of the Upper Navigation Fund. I do not think it is fair to ear-mark any particular part of the total fund.

Mr. RICKARDS in cross-examination: Your total revenue in respect of the Upper Navigation at the present time is, I understand, £23,765. Now, if you allocate to the Upper Navigation £6500 of the additional £7500 contributed by the Water Companies, your total income from that part of the river will be £30,265, of which sum the Companies would contribute £23,165; or, in round figures, something like four-fifths of the Upper Navigation Fund would be contributed, under this arrangement, by the Companies?

Witness: Yes; about 75 per cent.

Am I putting it too high when I suggest that the Companies' contribute that large proportion of your revenue with regard to the Upper Navigation in order that you may purify the river, and make it fit for the purposes of water supply?—I believe that is the object of the Conservators.

Do you not think it is a sound principle that, where money is found for a particular purpose, such as the prevention of pollution, it should be applied for that purpose?—I did not say for the prevention of pollution. I said for improving the water of the river by the prevention of pollution or otherwise.

Then I ask you this: Do you not think that, the money being found by the Companies in order to make the water more fit for the purposes of supply, it is reasonable and fair that it should be applied to that purpose?—It is; and it will be so applied.

Do you not think that the whole of the money found by the Companies should be expended for the purpose for which it is found?—It is, and will be, applied to that purpose.

To that purpose exclusively?—Yes, so far as the Companies are concerned; but, of course, other persons will share any advantages that flow from it.

Mr. BAGGALLAY: With regard to the additional £7500 which is now to come from the Water Companies, you are prepared to have a portion of that distinctly ear-marked for the purpose of preventing pollution—that is to say, for the purpose of carrying into effect the provisions of this Bill in relation to pollution?

Witness: Yes; I think so.

With regard to your existing income from the Companies, and any balance there may be after the Committee have fixed the amount to be applied to the prevention of pollution, in your opinion ought that to be no more ear-marked in the future than it has been in the past?—Certainly it ought not to be. Going back to the origin of the payments by the Companies, there is nothing in the Act of 1866, by the provisions of which the Companies first came under a statutory obligation to pay these sums to the Conservators, ear-marking the application of the moneys; and the only other Act which has dealt with this matter up to the present time—viz., the Act of 1878—did not in any way ear-mark the application of it.

Do I understand you aright, that the benefits which the Companies have obtained under the Act of 1886, and subsequent Acts, are not limited to the mere prevention of pollution?—Decidedly that is my meaning; and I include the benefits inuring to the Companies from the works and various other matters.

After further evidence and arguments by Counsel,

The CHAIRMAN announced that the Committee had come to the conclusion that though, if they were dealing with the matter for the first time, probably Teddington would be the best point of division between the Upper and Lower Navigations, they saw possible difficulties in the way of any alteration; and they had not been convinced by anything put forward that there would be more than a sentimental advantage in the change. Therefore they had decided that Staines should continue to be the dividing-point.

Friday, June 1.

On the resumption of the proceedings this morning,

Mr. BAGGALLAY brought up the clauses drafted by the promoters relating to the water portion of the Bill; and Nos. 284, 286, and 287 were passed.

Mr. COHEN, on behalf of the London County Council, contended that clause 288, as drafted, would indirectly enable the Water Companies to take more water from the River Thames than they were legally entitled to; and he suggested that they should be restricted to the purposes "for which the said Companies were, at the time of the passing of the Act of 1878, respectively empowered to provide and use water."

Mr. BAGGALLAY said he had carefully considered the amendment proposed by the London County Council, and had come to the conclusion that he could not accept it, because, while the Conservators were anxious that nothing in the Bill should augment the quantity of water which a Company might lawfully take from the river at the date of the instruction, they did not see their way to restrict, by date or otherwise, the purposes to which the Companies might legitimately apply that water. If they were to restrict it to a particular date, it would probably give rise to a great deal of litigation; and it was most undesirable to do this. No one would be able to tell five years hence exactly when an agreement for a supply was entered into by one Company with another, and what were the limits of the purposes for which the Company were empowered to provide and use the water on a particular date in 1878. For instance, supposing, within a certain district, there had been an increase of building, the Company would not have been empowered to provide and use water for the houses which were non-existent in 1878.

Mr. PEMBER: That is so. But your clause says: "Provided also that, subject to the provisions of the said section ['Power of Intersale by Metropolitan Water Companies'], and of sub-section 2 of this section, nothing in this Act should take away, prejudice, or affect any right, power, or authority of any of the Metropolitan Water Companies to take any quantity of water from the Thames in any such day as aforesaid, which such Company might, but for the passing of this Act, have lawfully taken in such day, or prejudice or affect the validity or otherwise of all or any part of any of the agreements mentioned in the sixth schedule to this Act."

Mr. BAGGALLAY: Quite so; it is limited entirely to the agreements legally made under the powers of the Act. I do not think it would be wise to make the alteration which my learned friend Mr. Cohen suggests. I consider it would only become the foundation of a good many doubts; and probably of a great deal of litigation.

Mr. COHEN: I think it will be found that, if the clause is left as it is at present recommended by the promoters, it will indirectly enable the Companies to draw more water from the Thames than they are legally entitled to take. If you will look at section 15 of the Thames Conservancy Act of 1878, you will see that it provides that, "subject and without prejudice to all other terms and conditions contained in any subsisting agreement or Act of Parliament, it should be lawful for any one of the six Companies to supply any part of the respective total quantity of water which they are respectively empowered to take from the River Thames." The promoters have followed the amendments suggested by the London County Council, in so far as they have struck out the original words, and have added "or agreements subsisting and in force at the passing of the Act of 1878." But then this section goes on: "It shall be lawful for any one of the six Companies to supply any part of the respective total quantity of water which they are respectively empowered to take from the River Thames, or from any tributary thereof, and which is not required for the purposes of the respective districts, to any other or others of the six Companies, to be used only for the purposes for which the six Companies are respectively empowered to provide and use water." That is to say, they are respectively empowered to take from the Thames, or from any tributary thereof, water which is not required for the purposes of the respective districts by any other of the six Companies, but "to be used only for the purposes for which the six Companies are," at the time of the passing of the Act, "respectively empowered to provide and use water." I submit that, if the Committee do not confine the words to the time of the passing of the Act of 1878, they will indirectly enable one Company to take water to an extent beyond that to which they are entitled to take it at the present moment; and that, I submit, would be acting contrary to the instruction given to this Committee.

The CHAIRMAN: Your contention is that the limitation of the earlier words does not apply to purposes for which the water might be used?

Mr. COHEN: Yes.

The CHAIRMAN: But are not the latter words made subject to the provisions in the agreements existing under the Act of 1878?

Mr. COHEN: To make the whole clause consistent, it ought to run "only for water used for the purposes for which the Companies were, at the passing of the Act of 1878, empowered to provide and use water." The understanding upon which the London County Council withdrew their opposition to the second reading of the Bill was that none of the Companies were to be authorized to take, either directly or indirectly, any more water from the River Thames than they are now legally entitled to take. It is to give full effect to the understanding, and only for that purpose, that the Council desire the amendment which I have foreshadowed.

Mr. PEMBER, on behalf of the Water Companies, argued that Mr. Cohen had altogether misconceived the object of section 15 of the Act of 1878. He said there was no limitation of quantity there at all. The sole limitation was that, when one Company had sold water to another, they should only apply this water to the purposes for which they were empowered to provide water. If this was the correct view, clause 15 would enable any Company who bought water to apply it to purposes for which they were at present entitled to provide water.

After some further discussion,

The CHAIRMAN said: The view of the Committee is that the clause does, by the later words, limit the total quantity of water, and that the words suggested by Mr. Cohen are unnecessary.

Clause 288, as amended, was passed.

Mr. PEMBER: You must not take it, Sir, that I give my assent to clauses 284, 285, 286, and 287. I wish to guard the rights of my clients; and I simply interposed on clause 288 because of the intervention of my learned friend Mr. Cohen, to whose proposal I was opposed.

Mr. BAGGALLAY: Then as to clause 289, if you remember, Sir, your decision was that the clause should be re-drafted, so as to make it clear that the instruction of the House was complied with; and you also decided that nothing should be done in any way to prejudice the interests of the Companies. In order to make it perfectly clear that we do not injure the Companies, we have left out the figures in the schedule, all reference to the gravel-bed water, and the provision as to the heavy penalties. Having done this, we split up the clause into

two parts, the first of which is as follows: "Subject to the provisions of this Act contained in the section thereof whereof the marginal note is 'Power of Intersale by Metropolitan Water Companies,' the Metropolitan Water Companies, the West Surrey Water Company, and the South-West Suburban Water Company respectively should not, unless and until otherwise authorized so to do by Parliament, take a quantity of water from the Thames greater than the quantity which such Company might lawfully have taken on the 5th day of April, 1894." That is the date of the instruction. We stop there; and then we propose to insert a subsequent clause (289A) dealing with the question of the appliances for registering the quantity taken from the river, and sending returns to the Conservators. I submit that the clause in this form will carry out the decision of the Committee upon the lines indicated by them.

Mr. COHEN submitted that clause 289, as now drawn, necessarily implied that the preceding clause gave power to the Companies to take more water than they would be entitled to take at the time of the instruction. The other words to which he objected were "unless and until otherwise authorized so to do by Parliament." No Parliament could bind a future Parliament; and either those words were as nugatory as they were unusual, or they invited Parliament in the future to make an alteration, and authorize the Water Companies to do that which they were not entitled to do. With regard to the other amendments proposed by the promoters, he had nothing to say. They were the amendments originally proposed by the County Council.

Mr. PEMBER, on the other hand, contended that clause 288, following exactly the verbiage of section 15 of the Act of 1878, would carry into the Act of 1894 the power of intersale by the Metropolitan Water Companies without altering it. Then, on account of the negative form of clause 289, which was not a positively enabling enactment, but a clause of limitation, which said that the Companies should not take more than a certain quantity of water, it was necessary to refer to clause 288, because this was the clause which, in connection with section 15 of the Act of 1878, gave the power of intersale; and unless the words "subject to the provisions of this Act contained in the section thereof whereof the marginal note is 'Power of Intersale by Metropolitan Water Companies,'" were inserted, there would be a distinct prohibition, in the case of each individual Company, against their taking more than a certain quantity of water on account of the disenabling form of clause 288.

Mr. BAGGALLAY argued that the other words objected to by Mr. Cohen, "unless and until otherwise authorized so to do by Parliament," were necessary, in order to make it clear that it was not a final decision of Parliament that water should not at any time be allowed to be taken in greater quantities from the river. The Conservators did not wish to prejudice that question.

The CHAIRMAN: The view of the Committee is that the clause should stand in the form proposed by the Conservators.

Mr. PEMBER then asked the Committee to delete from sub-section 1 of clause 289 the enactment that every agreement for a continuous supply under the powers of the section "shall contain due provisions that the supply so made shall not be withdrawn without the consent of the purchasing Company." It was quite clear that, if the Lambeth Company, for instance, undertook to sell 5 million gallons of water to the Southwark and Vauxhall Company, the purchasing Company would take care that there was a proper provision to the effect that the selling Company should not cease to give them a supply, except upon certain notice. The words which he asked the Committee to strike out would tie the hands of the selling Company.

The CHAIRMAN: Surely if you agreed to supply another Company with a million gallons of water a day for twelve months, your agreement would come to an end at the close of twelve months.

Mr. PEMBER: Yes. But then this clause says you shall not make such an agreement, because it says you shall not enter into an agreement which does not contain a provision that the supply so taken shall not be withdrawn without the consent of the purchasing Company.

The CHAIRMAN: It would not, if it were made only for a limited period.

Mr. PEMBER: But, on the other hand, no Company would take an agreement for any such period, because they would say: "We dare not commit ourselves to an agreement for only a twelvemonth."

The CHAIRMAN: Would they be more likely to make an agreement under conditions that you might withdraw the supply any moment?

Mr. PEMBER: No; but supposing that an agreement were made (say) to sell water for five years, and that at the end of five years either the purchasing or the selling Company might give so many months' notice to resile from that agreement, but in the event of no notice it went on for five years more, we will say, that would be a very proper agreement to make; but I am afraid such an agreement as that would be impossible under the clause as it stands.

The CHAIRMAN: Would it not imply the consent of the purchasing Company if they made such an agreement, subject to notice?

Mr. PEMBER: Yes.

Mr. BAGGALLAY: I may say at once that the Conservators have no opinion one way or another about the words to which my learned friend Mr. Pember objects. They do not wish to preserve them if the Water Companies object to them. They do not serve any purpose with regard to restricting the quantity of water taken from the river or any claim in which the Conservators are interested.

The CHAIRMAN: I think the words had better stand.

Mr. PEMBER: Very well, Sir, if you think so. At the same time, I hope my learned friend Mr. Baggallay will understand that I do not pledge myself not to object to these words again when the Bill comes before the House of Lords.

Mr. BAGGALLAY: I quite understand that.

Mr. PEMBER: Then we come to sub-section 2 of clause 289A—the gauging clause—as to which the Water Companies have something to say. With reference to this matter, I would much rather depend upon Mr. Parkes, the Engineer of the Lambeth Water Company, as I do not understand these mechanical points; and, with the permission of the Committee, I will just ask him a question or two upon the subject.

Mr. *T. F. Parkes*, examined by Mr. PEMBER, explained that the Lambeth Company's pumping-engines were already fitted with certain apparatus which registered the strokes by means of counters. In this way the quantity of water pumped was estimated with a fair approach to accuracy. He was not aware of any other apparatus which would answer the purpose so well as that at present in use; and, so far as the Lambeth Company were concerned, inasmuch as a large proportion of their water was taken by means of gravitation, he did not conceive how it could be measured by an appliance which must necessarily restrict the supply.

Mr. PEMBER: And you cannot conceive of any gauging apparatus which would not restrict the supply, I suppose by impeding the flow?

Witness: That is what I mean.

Mr. PEASE: Is there not some apparatus which can be fixed in the engine-house to test the quantity of water taken better than by counting the strokes of the engine?

Witness: I do not know of any other, except a meter; and a meter is constructed on the same principle as the pump of an engine.

Cross-examined by Mr. BAGGALLAY: He could not tell whether the Company were under any statutory obligation at the present time to keep returns of the water taken from any source. The Company took water from two sources—viz., by gravitation from the river, and also by an intercepting pipe laid within about twelve yards of the river. Those waters became mixed either at the end of the main at Ditton or else in the subsiding reservoirs at Molesey, at the intake.

By the CHAIRMAN: That would be before passing through the pump.

By Mr. BAGGALLAY: The Company had separate pumps, and separate means of ascertaining the quantity of water taken from the Thames itself and from the gravel beds. Separate automatic registers were kept at both pumps, from which the returns were made; and those returns were, in his opinion, quite satisfactory. There was no difficulty whatever in ascertaining, by means of the present appliances, how much water was taken in any given period.

Mr. BAGGALLAY: Then how will the proposed clause hurt you?

Witness: I was referring chiefly to having to put a weir or gauge on the culvert which supplies us by gravitation.

Is not that rather assuming that the Conservators and the Board of Trade would be so unreasonable as to call upon you to adopt some more satisfactory appliances, if, in their opinion, you do not already possess them?—In my opinion, our present appliances are satisfactory; and therefore I do not see the reason for the clause.

But you might discontinue them to-morrow, might you not?—Of course that is so.

Mr. PAULTON: I suppose you would consider that the Conservators would prefer to have the most accurate machine that could be used?

Witness: Yes; and I consider they have it now.

Mr. PEMBER: I think I might go the length of accepting the clause, if the words "measuring or otherwise ascertaining" are inserted.

Mr. BAGGALLAY said he would agree to this.

The CHAIRMAN: Very well. Then the clause will be inserted in the Bill.

Mr. BAGGALLAY, dealing with the fifth schedule, fixing the additional contributions payable by the Water Companies under the Bill, said that since the Committee had settled the total amount of the contributions at £7500, it had become necessary to make a redistribution of the contributions. In doing so, it was not proposed to impose anything extra upon the West Surrey Company and the South-West Suburban Company; and therefore the whole of the £7500 would be distributed among the six big Companies. Accordingly, £1200 was put upon the Chelsea Company, £1250 upon the Southwark and Vauxhall Company, £1350 upon the Lambeth Company, £1350 upon the West Middlesex Company, £1350 upon the Grand Junction Company, and £1000 upon the East London Company.

Mr. PEMBER objected that, under this plan of distribution, the total contribution of the last London Company was left at £3000, the same as it would have been if the Committee had not reduced the amount of the extra contributions by £4000 or £5000. This, he maintained, was an unfair adjustment; and he asked that it should be modified in the case of the East London Company, which was not one of the associated Companies.

After considerable discussion,

Mr. LITTLER, on behalf of the Conservators, offered to apportion the payment of the £7500 as follows: Chelsea Company, £1250; Southwark and Vauxhall Company, £1000; Lambeth Company, £1500; West Middlesex Company, £1500; Grand Junction Company, £1250; and East London Company, £1000.

Mr. PEMBER: I have persuaded the East London Company not to fight this point any further.

Mr. LITTLER: Then I have nothing more to say.

The CHAIRMAN: Then the schedule stands as it is, does it?

Mr. BAGGALLAY: Yes; the schedule stands as it is—as amended, of course.

The CHAIRMAN: I think the better plan will be to postpone clause 285 until next Tuesday, and then Mr. Pember can suggest any amendment which occurs to him after having considered the matter.

The further consideration of clause 285 was accordingly postponed.

Wednesday, June 6.

The clause fixing the amounts to be paid by the Water Companies came up again to-day, having been postponed from Tuesday.

Mr. BAGGALLAY stated that the figures, as settled, had been agreed upon—the East London Company remaining as at present, and the two smaller Companies as in the schedule.

The clause, as amended was passed, together with the schedule.

Proposed New Holder for the Bangor Gas-Works.—It was reported at last Wednesday's meeting of the Bangor City Council that, before next winter, an additional holder would be required at the gas-works, as otherwise it would be difficult to keep up a sufficient supply. The consumption during last winter reached 50 per cent. more than the capacity of the present holders; and the supply in the coming winter could only be maintained at a greater expense. The erection of a new holder of not less than 120 feet diameter had been recommended by the Gas Manager; and the matter, it was stated, was receiving the attention of the Gas Committee.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Thursday, July 5.

(*Before Lord Justices* LINDLEY, LOPES, *and* DAVEY.)

Grand Junction Water-Works Company v. Brentford Local Board.

This was an appeal by the defendants from the order of Mr. Justice Lawrance, made on the 7th of April last,* at trial without jury; and the question was whether, under existing circumstances, the defendants were liable for the maintenance of the fire-plugs belonging to the plaintiffs. The defendant Board have the control and management of the streets under the Public Health Act, 1875, for paving and improving the district of Brentford, to be supplied with water under the Grand Junction Water-Works Act, 1852, and other Special Acts within the true intent and meaning of the Water-Works Clauses Act, 1847. After the passing of the last-mentioned Act, the plaintiffs—it was alleged, at the request of the defendants—fixed certain fire-plugs in the main and other pipes belonging to them, in the positions and as required by the 38th section of the Act. From March 31, 1886, to March 31, 1892, the plaintiffs had from time to time renewed and kept the fire-plugs in effective order. But the defendants declined to defray the cost of maintaining them in repair; and accordingly the action was brought to recover the sum of £194 15s. 3d., which had been expended in so doing. The defendants denied that they at any time, or in any way, requested the plaintiffs to fix the fire-plugs; and they also relied on the Statute of Limitations. To this the plaintiffs replied that, if the plugs had been put in without request, the Local Board, by their acts, had adopted what had been done; and in the event of the plugs being removed, they would have to incur the cost of replacing them. Consequently it was idle to raise the present contention.

Mr. MURPHY, Q.C., and Mr. J. C. EARLE appeared for the appellants; and Mr. JELF, Q.C., and Mr. BAUGH-ALLEN, for the respondents.

Lord Justice LINDLEY said the case depended upon the true construction of the Act of Parliament, and upon such inferences as could properly be drawn from the acts of the parties. The case had been put in two ways: (1) That there was a statutory obligation, in which case the action was maintainable; and (2) that if there was not a statutory obligation, at all events there was an obligation which had been contracted. This obligation arose from an agreement to pay which was to be inferred from the conduct of the parties, as it was admitted that there was no agreement in writing to pay, still less one under seal. The statutory obligation was put by the learned Judge in the Court below upon section 66 of the Act of 1875. But Counsel for the respondents felt that it was difficult to maintain this view; and accordingly they had not rested their case upon that section. The section provided that the urban authority should cause fire-plugs to be provided, and for this purpose to enter into agreement with the Water Company; but this did not provide for the payment for the plugs. With great deference to the learned Judge, he thought he had misconceived the scope and purpose of section 66. The statutory obligation was to be found, if at all, in sections 38 to 42 of the Water-Works Clauses Act, 1847. The 38th section provided that the Water Company should, at the request of the Town Commissioners (who were the predecessors of the Local Board) fix fire-plugs in the pipes belonging to them, for the purpose of extinguishing fires; and section 39 provided that the Company should keep the fire-plugs in effective order. Pausing there, the obligation was fixed; and the obligation to renew and keep in order was imposed on the Water Company. Section 40 provided that the cost of such fire-plugs, and the expense of fixing, placing, and maintaining the same in repair, and of providing keys, should be defrayed by the Town Commissioners. This made it a statutory obligation on the Commissioners to pay the cost of such fire-plugs. The expression "such fire-plugs" was a little ambiguous. It might mean proper fire-plugs in the main and other pipes, or fire-plugs fixed at the request of the Town Commissioners under section 38. The real meaning was to be gathered from the next section, which provided that the Company should, at the request of the owner and occupier, place and maintain some other plugs. The scheme was this: You, the Water Company, are to fix the things and keep them in order. If you fix them at the request of the Town Commissioners, it is at the expense of the Commissioners; if you fix them at the request of other people, it is at the expense of those other people. The present case could not be brought within the class of fire-plugs fixed by the Town Commissioners, so that there was no statutory obligation. The fire-plugs were not put up at the request of the Local Board. As to the point of obligation by contract, there was no evidence of contract at all. If the agreement was to pay for the plugs *en bloc*, the difficulty arose that there was no agreement under seal; or if the payment was to be for each plug, then the agreement would have to be split up into as many agreements as there were plugs. The Court had nothing to do with what was fair or unfair, but merely to declare a statutory right.

Lords Justices LOPES and DAVEY concurred.

The Appeal was therefore allowed, with costs.

SOUTH-WESTERN POLICE COURT.—Tuesday, July 3.

(*Before Mr.* ROSE.)

Newlyn v. Lambeth Water Company.—The Bath Question.

To-day his Worship gave his decision in the above case, which had been before him on several occasions. The plaintiff—Mr. H. M. Newlyn, of "Camerton," Forest Hill Road—had obtained two summonses against the Lambeth Water Company for having neglected to supply him with water for domestic purposes. There had been frequent disputes between the parties as to the charges for plaintiff's bath from the time he entered into the occupation of his house, in 1890, down to 1893, when the case which was decided by Justice Chitty on April 11 last, as reported in the JOURNAL at the time, was pending. When this was decided, the Company sent round a circular informing the consumers that, if they continued having the water for baths without an agreement to pay 2s. 6d. per quarter in respect thereof, the supply would be discontinued. To this the plaintiff responded that the Vestries were about to take some step in the matter, and that he would await the result of an appeal. The Company replied that there was no notice of appeal; and they failed to see how the Vestries could have *locus standi*. Then Mr. Newlyn received a claim for £5 6s. 6d., being six quarters' water-rate to Midsummer, 1894, and the balance of the bath-rate due. On the 4th of May, Mr. Johnston, the collector, called, and to him the plaintiff tendered £5 in cash; being the rate he admitted until Christmas, 1894. This was what he had been accustomed to pay. The collector refused the amount; and the same day returned with the notice of cutting off. It was submitted that the tendering of the £5, which was more than the amount due (if plaintiff's contention were right) constituted sufficient tender under the Act. Plaintiff, however, was nervous; and, after making an elaborate calculation of the amount due to Midsummer, 1894, he called and tendered £3 13s. 9d. It was contended that, though plaintiff's house was provided with a bath, it was never used.

Mr. H. SUTTON appeared for the plaintiff; Mr. HORACE AVORY represented the defendants.

Plaintiff having corroborated the statement of the facts as set forth on his behalf,

Mr. AVORY, for the Company, argued that the tender by the complainant was bad because it was not made on the quarter day, bad because it was out of time, bad because it was made with the condition "Do you accept it—yes or no?" and bad because the sum tendered was not enough. He relied on the section of the Water-Works Clauses Act which empowered the Company to cut off a supply of water when the rates remained unpaid.

Mr. ROSE, in a long judgment, held that the tender was a valid one. Referring to one of Mr Avory's contentions, Midsummer-day, he said, fell on a Sunday; and it could not be supposed that the Company were entitled to cut off a supply of water if the rates were not paid on that day. Attention had been drawn to the fact that the taps were attached to the plaintiff's bath. He did not think the complainant had been guilty of wilful neglect in omitting to remove them; and he was of opinion that the Company were not justified in stopping the supply from the whole of the house on the assumption that the bath was being used. He was satisfied that the complainant was entitled to a supply of water; and he imposed a penalty of £10, in addition to 40s. in respect to one of the days on which he was deprived of a supply.

Application was made for costs; but it was refused—his Worship thinking that Mr. Newlyn had acted unreasonably in allowing the taps to remain fixed to the bath.

Gas-Meter Rents at Bolton.—At the meeting of the Gas Committee of the Bolton Corporation on the 29th ult., it was decided to abolish the rents for gas-meters in the borough.

The Price of Gas at Chorley.—The Chorley Town Council have decided that the price of gas shall be 3s. 9d. per 1000 when the consumption is under 200,000 cubic feet, and 3s. 3d. when above.

Chinese Water-Works.—There has been much talk among Chinese of establishing water-works at different cities on the Yangtze, says the writer of a recent Consular report; and the advantages which Shanghai gains from the establishment of its Water Company are frequently referred to and fully recognized. There are vested interests, such as those of water porters and the like, which are opposed to the introduction of similar enterprises elsewhere; but the gentry at places like Yang Chau, Nanking, and Chinkiang know how to overcome such opposition when it suits their purpose. Any such schemes will undoubtedly be worked by native capital; and there will be some hesitation before money is invested in such an enterprise, in some degree under official control, unless the investors are satisfied that the results ought to be satisfactory, financially and otherwise. The present Viceroy at Nanking is understood to be opposed to the inception of any water-works for domestic purposes. But there are many officials who hold opposite views; and public opinion is as strong a factor in China as elsewhere, though very slow in exercising its strength. Water-works, fire-engines, and hydrants appear to have a field open to them in the future, on account of the universal favour which those in use at Shanghai have won. The writer is convinced that it is by the introduction of such appliances into use among the foreign communities in China that manufacturers will best advertise their goods, unless they go to the expense of sending out special agents to open exhibition yards and supervise machinery in work.

Fylde Water-Works Company.—The new works of the Fylde Water Company (which have been in course of construction for the past two years) have been satisfactorily completed; and they were formally brought into use last Thursday week. They are situated at a distance of about 4½ miles from Garstang, and have been built with the object of taking the water from Calder River and Calder Dyke. The area of the gathering-ground is about 2000 acres; and the greatest altitude is 1520 feet, which falls to 620 feet at the lower end. The ground is free from buildings and all danger of pollution; and the water is soft and pure. The works consist of masonry intakes at the Calder Dyke and Calder River; and from the latter place the water is sent down a large conduit to a valve chamber, by means of which it is turned into the north or south Barnacre or Grizedale reservoirs, or directly to the new filter-beds. The inclination of the conduit is 6 feet in a mile; and when it is full, it will discharge 2,900,000 gallons an hour. The culvert is constructed of concrete, with the invert lined with blue brick. From the valve-chamber at the west end of the culvert iron pipes, 30 inches in diameter, are laid, with a fall of 80 feet to the hill overlooking Grizedale reservoir, where 22-inch pipes are used. The two filters are situated at the north of Barnacre reservoir, and about 50 feet below. The floors and walls are of cement concrete, lined with red pressed bricks; and the tops of the walls are finished with machine-dressed stone coping. Filtration takes place through five layers of broken stone and sand 4 feet deep. The Engineer of the works was Mr. E. Garlick, of Preston.

* See JOURNAL, Vol. LXIII., p. 715.

MISCELLANEOUS NEWS.

THE OPPOSITION OF THE PRESTON CORPORATION TO THE GAS COMPANY'S BILL.

The minutes presented by the Finance Committee at the meeting of the Preston Corporation on the 29th ult. contained a reference to the result of the opposition to the Gas Company's Bill. In submitting the Committee's proceedings for confirmation, Alderman Forshaw said that the Corporation did not go to Parliament for the purpose of throwing out the Bill. Had such been their intention, they might possibly have succeeded. But, instead of that, they thought it more desirable, in the interests of the ratepayers, that they should endeavour to secure a modification of the rates and charges—in short, they wanted to procure for the consumers the best kind of gas at the cheapest rate possible. Up to now, the Gas Company had never been under any sort of parliamentary direction which would tend to induce economy; and the Corporation thought the introduction of the sliding-scale and the neutral zone would effect the desired object. This they had obtained, through the intermediary of the House of Commons Committee. Under this arrangement, the net prices ranged from 2s. 11d. to 3s. 3d. per 1000 cubic feet. If they charged 3s. 4d., the stock bearing 10 per cent. must come down to £9 15s., the 7 per cent. to £6 16s. 6d., and the 5 per cent. to £4 17s. 6d., and so on, proportionately for every penny they put on. There was therefore a deterrent penalty against their charging a great price. It would be observed that 2s. 11d. was the bottom of the neutral zone; and between that figure and 3s. 3d., the Company would not be affected. But the moment they found they were able, through the practice of economy, to charge less than 2s. 11d., they had a premium offered to induce them to do so. For example, if they could see their way to charge 2s. 10d., their dividends on the various stocks might be increased to £10 5s., £7 3s. 6d., and £5 2s. 6d., and so on proportionately. Therefore, on the one hand, they had a direct incentive to reduce their prices to the lowest practicable figure; and, on the other, they were penalized for extravagance if they charged a greater sum. He thought he might say the Corporation had showed conclusively before the Parliamentary Committee that the Company had been excessively extravagant in the past—in fact, they were in the unique position of being nearly the highest as regards the cost per million cubic feet of gas produced. They had created 10 per cent. and 7 per cent. stock, and allotted it among their own shareholders; and thus they seemed to have had a direct incentive to extravagance. But now that they were bound to sell their stock in the open market, and the sliding-scale had been adopted, he thought the public would be in a better position. Members of the Council would therefore probably admit that the Corporation interference had been for the benefit of the ratepayers, and that the expenditure on their opposition was justified. The Committee's proceedings were approved.

METROPOLIS GAS SUPPLY.

The London County Council and the Price and Quality of Gas.

In accordance with the instructions of the Public Control Committee of the London County Council, the Chemist and Superintending Gas Examiner of the Council (Mr. W. J. Dibdin, F.I.C., F.C.S.) has lately presented to the Committee three important reports dealing with the price, enrichment, and testing of gas in the Metropolis. They came before the Council last Tuesday, and were ordered to be distributed among the members; and, in view of their interest, we make the following extracts from them.

The first report is on the subject of the price of gas; and in it Mr. Dibdin sets forth the circumstances which have contributed to the present variations. In order to make his statement as explicit as possible, he gives the following table showing the position of the London Gas Companies in 1869—the year after the passing of the City of London Gas Act :—

Company.	Capital Employed.	Quantity of Gas Sold.	Price per 1000 Cubic Feet.
		Cubic Feet.	
(1) Gaslight and Coke .	£1,304,036	1,285,602,000	4s. (cannel 5s. 6d.)
(2) City of London . .	456,825	533,661,000	4s. (cannel 5s. 6d.)
(3) Great Central Gas Consumers . . .	266,000	465,667,000	4s.
(4) Equitable	300,000	398,841,000	4s. (cannel 5s. 6d.)
(5) Western	404,730	455,432,000	5s. 6d. (cannel)
(6) Imperial	2,083,721	6,868,999,000	4s.
(7) South Metropolitan .	269,723	534,246,000	3s. 4d. to Sept. 30 3s. 2d. from ,,
(8) Commercial . . .	437,230	659,262,000	4s.
(9) Independent . . .	235,800	440,658,000	3s. 4d.
(10) London	745,853	822,852,000	4s. (cannel 5s. 6d.)
(11) Phœnix	943,296	962,004,000	4s. 3d. and 4s.
(12) Ratcliff	115,670	147,228,000	4s. 6d.
13) Surrey Consumers .	265,960	311,405,000	4s.
Totals	£7,828,844	9,885,857,000	

Situation of Works.—(1) Horseferry Road, Westminster; Brick Lane, St. Luke's; Curtain Road, Shoreditch. (2) Blackfriars. (3) Bow Common Lane. (4) Grosvenor Road and Lupus Street, Pimlico. (5) Kensal Green. (6) Fulham, St. Pancras, and Haggerston. (7) Old Kent Road. (8) Stepney. (9) Kingsland. (10) Nine Elms Lane. (11) Bankside, Vauxhall, and Greenwich. (12) Wapping; Johnson Street, Commercial Road. (13) Rotherhithe.

The position of the Companies thus defined was varied by successive amalgamations; and on Dec. 7, 1875, the Parliamentary Committee of the Metropolitan Board of Works (the Council's predecessors) reported strongly on the scheme for the amalgamation of the Imperial and Independent Companies with The Gaslight and Coke Company. Mr. Dibdin quotes this report in full; and in regard to it says: "This unsparing condemnation of the policy of absorption pursued by the larger Companies did not, however, stay their hands, as successive amalgamations followed until nearly the whole of London within the Metropolitan area is supplied at the present time by the three large Companies—viz., The Gaslight and Coke, the South Metropolitan, and the Commercial; the Companies supplying the remainder being the Crystal Palace District Gas Company, the Mitcham Gas Company, and the Brentford Gas Company." He goes on to explain that the variation in the present price of gas is regulated by sliding-scale; and he then proceeds as follows: "Under the provisions of this arrangement, which was first applied to the Commercial Gas Company in 1875, the standard price to be charged was 3s. 9d. per 1000 cubic feet; but it was provided that the Company might increase or diminish such standard price subject to an increase or decrease in the standard rates of dividend as defined by the Act, to be calculated as follows: 'For every penny or part of a penny charged in excess or in diminution of such standard price in any year, the standard rate of dividend shall for such year be reduced or increased by five shillings in the hundred pounds per annum.' In the following year, the same standard price and sliding-scale were fixed for The Gaslight and Coke Company by their Act of 1876; the same sliding-scale for the South Metropolitan Gas Company, with the difference that the initial price should be 3s. 6d. instead of 3s. 9d. In 1877, the Woolwich, Plumstead, and Charlton Consumers' Gas Company adopted the same scale; the initial price in this case being, however, 4s. per 1000 cubic feet. In 1884, the Woolwich Equitable Gas Company came under the same conditions, but with an initial price of 3s. 6d. In 1885, the two Woolwich Companies amalgamated with the South Metropolitan Gas Company; and in 1879, the same Company absorbed the Surrey Consumers' Company—the initial price remaining at 3s. 6d. In 1883, The Gaslight and Coke Company amalgamated with the London Gas Company, without alteration."

In consequence of these successive amalgamations, and further increments of capital, the position of the three Companies supplying the greater part of London with gas was last year as follows:—

Company.	Capital Employed.	Quantity of Gas Sold.	Price of Gas per 1000 Cubic Feet.
		Cubic Feet.	
(1) Gaslight and Coke. .	£12,058,750	18,244,140,000	3s. 1d. common gas on north side of Thames 2s. 5d. common gas on south side of Thames
(2) South Metropolitan .	3,203,217	6,563,937,000	2s. 5d.
(3) Commercial. . . .	880,000	1,967,401,000	2s. 4d. & 2s. 6d. for public lighting and by contracts; 2s. 9d. per meter
	£16,141,967	26,775,538,000	

Situation of Works.—(1) Beckton, Bromley, Bow Common, Shoreditch, St. Pancras, Horseferry Road, Nine Elms, Kensal Green, and Fulham. (2) Old Kent Road, Bankside, Vauxhall, East Greenwich, Greenwich, and Rotherhithe. (3) Ben Jonson Road, Wapping, and Bromley.

Mr. Dibdin next refers to the present agitation respecting the difference in the price of gas charged in various parts of the Metropolis. On this subject he says: "In view of this agitation, Colonel Makins, the Governor of The Gaslight and Coke Company, is reported by the JOURNAL OF GAS LIGHTING to have said, at the half-yearly meeting on the 9th of February last, that the answer was to be found in the unique position of that Company in respect to the load factor upon the mains in foggy weather; and he further contended that, of the difference of 7·21d. between the price charged by that Company and the South Metropolitan Gas Company, charges for capital represented, 2·85d.; wear and tear, 0·57d.; taxes, 0·96d.; Beckton and Bromley coke, and the canal station expenses and losses, 1·38d.; and less favourable coal contracts, 1d.—making 6·76d. If it were not, he continued, for the peculiar conditions of the Company's supply, which no management of theirs could alter (it being the nature of the district), they would be able to sell gas at the same price as the South Metropolitan Gas Company. In comparison with this statement, the Chairman of the South Metropolitan Gas Company (Mr. George Livesey), at the half-yearly meeting of that Company on the 14th of the same month, said, in respect to the question of price, as reported by the JOURNAL OF GAS LIGHTING: 'One need not be much surprised at discontent arising under the circumstances; and the only remedy for removing it was to reduce the price of gas. He had been very sorry to hear, in the comparisons which were made at the meeting he had referred to last week, that it was attempted to show where the difference lay between the two Companies; but not one word was said as to the cause of the difference. It was a very clever accountant's statement, but it showed a total want of capacity for management; and the only other remark he had to make about it was that the whole gas industry of London was suffering because of the want of capacity of managing the business where the gas was being supplied at 3s. 1d. There was no reason why the Company which supplied the finest district in the world should not sell gas as cheaply as it was sold in less favourable parts.' On turning to the comparison of the accounts of these Companies for 1892, it is seen that The Gaslight and Coke Company paid a higher price for their coal (1·77d. per 1000 cubic feet of gas), and had heavier charges for working expenses (2·05d.), and capital employed (1·82d.) in proportion to the gas sold, than the South Metropolitan Company; while their proceeds from residual products were less (1·34d.) per 1000 feet of gas. In 1892, The Gaslight and Coke Company supplied 115 consumers per mile of main; while the Commercial Company supplied 82, and the South Metropolitan, 99. The gas sold per consumer was 82,931 cubic feet by The Gaslight and Coke Company, 87,736 cubic feet by the

Commercial Company, and only 78,816 cubic feet by the South Metropolitan Gas Company."

Mr. Dibdin next quotes two letters addressed to him by the Secretary and General Manager of The Gaslight and Coke Company (Mr. J. W. Field). In the first, this gentleman explains, in view of the objections sometimes raised to the payment of the statutory dividends, the origin and working of the sliding-scale and auction clauses; and he points out that the Directors have voluntarily applied the principle of sale by auction to the Company's loan capital, and that the average rate of interest now payable on both share and loan capital issued since 1877 is 4·78 per cent. He adds: "It is to the direct interest of the proprietors, as it is the earnest desire of the Directors, that the Company's gas should be sold at the lowest possible price; and the public may therefore rest assured that they will obtain immediately, and to the fullest extent, any advantage which the Directors may be able to secure by way of reduction from the current quotations for coal." Mr. Field's second letter was sent in reply to a "special question" put to him as to why, with so rich a district, his Company could not supply gas as cheaply as the South Metropolitan Company. He says: "The reply is that it is in the richer parts of our district the greatest disparity exists between the minimum and maximum daily consumption of gas; consequently, it is for these that special abnormal capital expenditure has to be incurred. And, as you doubtless know, having always to be prepared for such an emergency as an increase in 24 hours of 50 per cent. in our gas deliveries, we have to incur exceptionally heavy working expenditure in keeping a large number of retorts heated and ready for immediate charging; and then, after all these preparations, the foggy day may not come." Accompanying this letter were copies of the circular-letter and explanatory statement sent out shortly after the Company's meeting—the latter document being given in the JOURNAL for March 20 last (p. 533).

Mr. Dibdin closes his first report as follows: "From the foregoing, it would appear to be impracticable to endeavour to bring about any alteration in the price of gas in the Metropolis, with a view to a uniform charge, without an independent inquiry which would doubtless be of the nature of that instituted by the Board of Trade in 1873, when a small Commission of three members was appointed for the purpose of revising the scale of illuminating power and price of the gas supplied by The Gaslight and Coke Company, and as a result of which the present sliding-scale was eventually adopted. The question is one of necessarily a complex character, and probably such an inquiry would be a lengthy procedure. But, in view of the great commercial importance of the question, and the advantage undoubtedly gained by the public on a former occasion by the establishment of the sliding-scale, I submit that your Committee would be well advised in asking the Board of Trade to initiate an independent inquiry, and thus secure the whole subject being thoroughly investigated, with a view to the adoption of such modified prices as may be found possible."

The second report deals with the experiments carried out with the view of ascertaining the effect of sending out unenriched gas; and this we give in its entirety.

In accordance with the order of the Committee of the 13th of April last, I arranged with Mr. Livesey that the enrichment of the gas supplied by the South Metropolitan Gas Company should cease on the 24th of April, and be resumed on the 6th of May. During the interval, the gas was carefully tested as usual at the official stations, and also by means of the portable photometer at various points from Battersea to Plumstead; this instrument being taken into the official testing-stations from time to time for comparison with the legalized photometric apparatus. I now beg to submit the following outcome of the testings so made, together with a consideration of the results of the adoption of such an alteration in the existing standard, should such be further entertained, and recommendations with respect thereto. [The results of these testings will be found in Table I.] The higher result of the official examiners' tests is caused by the fact that, while the average illuminating power of the gas at all the testing-stations was 15·1 candles, the returns from the Clapham station alone gave an average of 15·8 candles.

The remarkable agreement between the indications afforded by the

TABLE I.—*Tests of the Illuminating Power of Uncarburetted Gas supplied by the South Metropolitan Gas Company from the 24th of April to the 5th of May*, 1894.

Date.	Locality.	Portable Photometer Testings.				Official Photometer Testings.		
		At Board Schools.		At Official Stations.		Candle Tests at Same Time as Portable Photometer Testings for Comparison.	Official Examiners' Reports.	
		Candles.	Pentane Argand.	Candles.	Pentane Argand.		At Nearest Station.	Average of all Stations.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Apl. 24	37, Bedford Road, Clapham	..	..	16·10	14·90	16·40	16·40	15·90
„ „	Stockwell Road	14·70	14·10	..	..	..	..	..
„ 25	Beresford Street, Walworth	14·90	13·80	..	..	..	15·40	14·90
„ 26	Pocock Street, Blackfriars Road	14·70	13·90	..	..	..	14·30	..
„ „	99, Blackfriars Road	..	..	15·80	14·20	15·20	..	15·10
„ 27	Albany Row, Camberwell	15·20	13·80	..	..	..	16·60	15·40
„ 28	Reddin's Road, Peckham	15·40	13·60	..	..	..	16·60	15·50
„ „	104, Hill Street, Peckham	..	..	16·10	14·70	16·10	..	..
„ 30	Canterbury Road, Old Kent Road	14·90	13·30	..	..	..	16·60	15·20
May 1	Tanner's Hill, Deptford	14·80	13·10	..	..	..	14·20	14·90
„ „	180, Lewisham Road	..	..	14·80	13·50	..	..	..
„ 2	Creed Place, Greenwich	14·30	12·90	..	..	..	14·60	14·50
„ 3	Bloomfield Road, Plumstead	13·90	13·10	..	..	..	15·70	14·90
„ „	211, Burrage Road, Plumstead	..	..	14·80	13·90	15·30	..	..
„ 4	Amie's Street, Battersea	15·60	14·20	..	..	..	15·30	15·00
„ „	Plough Road, Clapham	15·50	14·30	..	..	..	..	..
„ 5	Larkhall Lane, Wandsworth	15·50	14·10	..	..	..	15·60	15·00
„ „	37, Bedford Road, Clapham	..	..	16·50	15·00	..	..	..
	Average	14·97	13·68	15·68	14·37	15·75	15·57	15·12
	Average of tests comparable with col. 7, same date	14·70	13·90	15·70	14·42	15·75	15·75	15·35

The foregoing tabulated results may be summarized as follows—

	Candles.
Average of portable photometer tests at Board schools	15·0
Average of official examiners' tests	15·1

TABLE II.—*Tests of the Illuminating Power of Carburetted Gas supplied by the South Metropolitan Gas Company from the 8th to the 19th of May*, 1894; *being the Two Weeks following the Experimental Supply of Uncarburetted Gas.*

Date.	Locality.	Portable Photometer Testings.				Official Photometer Testings.	
		Board Schools.		Official Stations.		Official Examiners' Reports.	
		Candles.	Pentane Argand.	Candles.	Pentane Argand.	At Nearest Stations.	Average of all Stations.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
May 8	Beresford Street, Walworth	14·50	13·30	..	..	16·10	16·50
„ 9	99, Blackfriars Road	..	..	18·40	17·30	16·90	16·90
„ „	Pocock Street, Blackfriars	15·00	13·90	..	..		
„ 10	Albany Row, Camberwell	14·60	13·20	..	..	16·90	16·50
„ 11	Reddin's Road, Peckham	15·10	13·70	..	..		
„ „	104, Hill Street, Peckham	..	..	15·30	14·20	16·30	16·30
„ 12	Canterbury Road, Old Kent Road	14·90	13·70	..	..	16·20	16·30
„ 15	Tanner's Hill, Deptford	15·80	14·70	..	..		
„ „	180, Lewisham Road	..	..	16·50	16·10	16·40	16·70
„ 16	Creed Place, Greenwich	14·70	13·50	..	..	16·60	16·50
„ 17	Bloomfield Road, Plumstead	15·60	14·90	..	..		
„ „	211, Burrage Road, Plumstead	..	..	15·80	14·20	16·00	16·50
„ 18	Plough Road, Clapham	13·90	12·70	..	..	16·10	16·30
„ „	Amie's Street, Battersea	14·50	13·60	..	..	..	..
„ 19	Larkhall Lane, Wandsworth	14·70	13·20	..	..	16·30	16·40
„ „	37, Bedford Road, Clapham	..	..	16·90	15·80		
	Average	14·85	13·70	16·60	15·50	16·40	16·50

portable photometer and the official instruments is worthy of note, and is well shown by the following comparison—

	Candles.
(1) Candle tests on portable photometer at the official stations .	15·70
(2) Candle tests on the official photometer at the same time as the above	15·75
(3) Candle tests by the official examiner on the same days, but at different times	15·75

Many other features of interest present themselves on the careful examination of the details of the testings; but the above are the essential points in connection with the scope of the present inquiry.

It may now be assumed, from the results of the testings as thus set out, that the quality of the gas when uncarburetted is fairly uniform at the testing-stations and in the districts away from their immediate neighbourhood. The high results at the Clapham station were probably due to a special quality of coal employed at the Vauxhall works; so that the conditions in that case were exceptional, and somewhat complicate the general question. But even with this case included, the main point is practically unaffected—viz., that with uniform manufacture there is uniform quality. The question then naturally arises: "What are the conditions of the supply when the gas *is* being enriched?" For the purpose of answering this, a series of tests were conducted on precisely the same lines as the foregoing, immediately following the resumption of the process of enrichment by the Company. The results so obtained are given in Table II; and from them the following summary is obtained—

	Candles.
Average of portable photometer tests at Board schools . . .	14·85
Average of official examiners' tests	16·50
Average of portable photometer tests at official stations . . .	16·60

As the former set of testings, made when the gas was supplied uncarburetted, indicated a fairly uniform supply, so these later tests, made after the resumption of the enriching process, most clearly demonstrate that the effect of that process is limited in its operation to the official testing-place and its near proximity. This remarkable result is the chief outcome of the experiments; and it will explain any failure on the part of the consumers to detect any difference in the quality of the gas supplied to them during the two weeks in question.

The importance of the prescribed quality of the gas being fully maintained throughout the whole district is more than ever fully evident. For the purpose of elucidating this fact as clearly as possible, I have made the following series of experiments to determine the quantity of gas of different illuminating powers required to produce a uniform light when consumed in either of two of the most generally employed forms of gas-burners.

TABLE III.—*Consumption of Gas Required to Yield a Constant Light of Eleven Candles when Burnt in a Batswing and in a Fishtail Burner.*

[The standard of comparison used was the 10-candle pentane Argand, standardized against the 1-candle pentane flame in 1886.]

Illuminating Power (in Candles) of Coal Gas Tested by Pentane Argand.	Cubic Feet of Gas required to Yield 11 Candles when Burnt in a	
	Batswing.	Fishtail.
12·6	5·15	6·35
12·7	5·06	6·27
12·8	5·26	5·82
12·8	5·15	6·05
12·9	5·90	6·80
12·9	6·35	6·72
13·1	6·95	6·57
13·4	5·30	6·20
13·4	5·60	5·82
13·5	5·18	6·00
13·6	4·98	5·46
13·8	4·61	5·61
13·8	4·37	5·30
13·8	4·61	5·60
13·9	5·00	5·09
13·9	4·65	5·60
14·0	4·74	5·36
14·0	5·10	6·00
14·0	4·58	5·20
14·1	4·90	6·20
14·1	4·50	5·55
14·1	4·50	5·52
14·2	5·00	5·88
14·4	4·61	5·61
14·4	4·48	5·58
14·4	4·98	6·02
14·5	4·40	4·86
15·0	3·95	5·10
15·4	4·04	4·74
15·5	3·96	4·26
15·8	4·04	4·46

At the same time as the above tests were made, the gas was tested by candles, and found by the legal standard to average 15 instead of 13·9 candles, as indicated by the pentane Argand. The above results must therefore be corrected in that ratio. On averaging the values so found for successive increments in the illuminating power of the gas, the following corrected tabular comparison is obtained:—

TABLE IV.

Corrected Value of the Gas, in Terms of Legal Candles.	Cubic Feet of Gas required to Yield 11·87 Candles of Light from	
	Batswing.	Fishtail.
13·6 to 13·9	5·48	6·33
14·0 ,, 14·5	5·95	6·20
14·6 ,, 14·9	4·75	5·59
15·0 ,, 15·5	4·75	5·70
15·6 ,, 16·0	4·40	4·86
over 16	4·00	4·64

From these results, it appears that, in order to obtain the same quantity of light from a batswing burner consuming 14-candle gas as would be obtained with 16-candle gas, about 5 cubic feet per hour must be consumed instead of 4 cubic feet, or 37 per cent. more; with 15-candle gas instead of 16-candle, the increase is from 4 to about 4¾ cubic feet, or 18 per cent. With a fishtail burner, the increase in the quantity of gas, when 14-candle gas is employed, is about 33 per cent.; and when 15-candle gas is used, about 18 per cent. According to this comparison, the consumer who used either of these burners would have to pay 18 per cent. more for his gas to obtain equal intensity of light, in the event of the quality being lowered from 16 to 15 candles.

The price of the South Metropolitan gas is now 2s. 4d. per 1000 cubic feet. Mr. Livesey was of opinion, at his interview with the Committee, that, in the event of the abolition of the system of enrichment, the price might be reduced by 1d. The increase of 18 per cent. for reduced light-giving quality would raise the price by 5d. per 1000 cubic feet, or, allowing for the 1d. reduction, a difference of 4d.; thus raising the price for gas equivalent to 16 candles (the present standard) up to 2s. 8d. per 1000 cubic feet. This is a result which cannot be looked forward to with satisfaction on the part of the consumer. As will be seen from the foregoing, if the gas is lowered to 14 candles, this increase in price will be virtually doubled.

The foregoing may be shortly summarized as follows: (1) That the effect of the present system of enrichment is partial, and in proximity to the stations. (2) That the effect of a reduction in the quality of the gas is equal to a far larger increase in the quantity required for unit light than is compensated for by a reduction in price. (3) That the testings by the portable photometer are absolutely reliable.

In view of these conclusions, I respectfully submit that under no circumstances should the London County Council consent to a reduction in the quality of the gas; and that the attention of the Gas Referees should be directed to the obvious failure of the present method of enrichment, and to the urgent necessity that exists for ensuring the supply of gas of uniform and proper quality throughout the whole of the Metropolis.

In his third report, Mr. Dibdin deals at some length with the existing arrangements for testing gas. As in the previous case, we give practically the whole of the document.

In accordance with the order of the Committee of the 2nd of March last, I beg to report as follows on the existing arrangements for testing gas manufactured at the several works of The Gaslight and Coke Company, the South Metropolitan Gas Company, and the Commercial Gas Company (in completion of a former report, dated Nov. 6, 1883); also the position of the gas-testing stations appointed by the Gas Referees, and the quality of the gas supplied to the east of London and the parish of St. Luke.

Gaslight and Coke Company.

The gas supplied by The Gaslight and Coke Company is manufactured at eleven different works. The first in order of magnitude is Beckton, where the daily make for the past year averaged 27½ million cubic feet. The Bromley works, which are situated just outside the County of London, supply daily 4 million cubic feet. The works at Nine Elms yield a daily make of about 5 million cubic feet. The Fulham works make about 3 million cubic feet per day. The St. Pancras works supply daily about 2¾ millions; the Kensal Green works, about 3½ millions; the Haggerston works, about 1 million; the Bow Common works, on an average, 1½ millions; the Shoreditch works (late Independent), about 2½ millions; and the Pimlico works, ½ million. The average volume of gas distributed daily from these ten works of The Gaslight and Coke Company is about 53 million cubic feet. In addition to the foregoing, there are some small experimental works at Silvertown which distribute 400,000 cubic feet of gas to consumers in that part of Woolwich within the Council's jurisdiction. This gas is untested.

The gas manufactured at Beckton is stored at eight places, where special holders are reserved for the purpose—viz., at Beckton, where there is a storeage capacity of 19 million cubic feet; at Bromley, which takes 11 millions; at Shoreditch, which takes 6½ millions; at Fulham, which takes 4 millions; at Westminster, which takes 7 millions; at Nine Elms, which takes 1½ millions; at St. Pancras, which takes 3¾ millions; and Bow Common, which takes 1½ millions—making a total of 54 million cubic feet, not quite half the maximum daily make of the whole of this Company's works, which amounts to 117 million cubic feet.

The distribution of this vast quantity of gas is effected by means of a series of trunk mains, connected in such a manner that, in the event of an accident or other cause preventing the works in any particular district from maintaining an adequate supply, it can be furnished from works adjacent, or those at the extremity of the Company's system.

From Beckton the gas is conveyed to the Metropolis through two 48-inch mains, which run side by side through Plaistow Marsh to the Barking Road, thence along the East India Dock Road to Limehouse, where one diverges northward to the Bow Common works, thence southward, joining the Commercial Road East, near Limehouse Basin, and thence running parallel with the other 48-inch main along that road to the junction of the Whitechapel Road, where it separates into smaller mains. The other 48-inch main continues its course to Finsbury, thence north to Old Street, and south-westerly to New Oxford Street, thence southerly through St. Giles's and Charing Cross on to the Horseferry Road, Westminster, distributing-station. A 36-inch main runs from this in a westerly direction to Goswell Road, along that road and Farringdon Street to Blackfriars Bridge and the Thames Embankment to Horseferry Road. At the Victoria Dock Road a third 48-inch main is connected to one of those from Beckton, and runs north-westerly to the Bromley works, whence it runs, accompanied by another 48-inch main, in a north-westerly direction to London Fields, thence across the Kingsland Road nearly to Essex Road, Islington, and then south-westerly and southerly to the northern end of Aldersgate Street, where it joins the 48-inch main above-mentioned. From London Fields, a 36-inch main goes in a northerly

direction along Amhurst Road and Rectory Road to Stoke Newington Common, whence it proceeds as a 30-inch main across Stamford Hill along the north of Abney Park Cemetery.

From the Bow Common works, a 36-inch main runs north-westerly to the Mile End Road, then by that road and Houndsditch to Fore Street, and thence southerly to the Bank. From the same works, a 24-inch main runs westerly along Mile End and Whitechapel Roads, through the City, and round by the Thames to Westminster.

From the Shoreditch and Haggerston works, two lines of 24-inch mains run, first westerly, diverging near the Essex Road—one passing north-westerly to Upper Holloway, and the other south-westerly north of the British Museum and Oxford Street to the Edgware Road, where it is met by mains from Fulham and Westminster. A 24-inch main runs a short distance up the Edgware Road, thence south-westerly through Bayswater, round the Kensington Gardens and Hyde Park to Sloane Street, where it is met by the mains from Fulham and Westminster, which cross the park to Edgware Road.

From the St. Pancras works, a 36-inch main runs eastward to Goswell Road, where there is a distributing-station, receiving a 48-inch main from Beckton and a 24-inch main from Shoreditch. A second 36-inch main runs from these works to Portland Road, Regent's Park; there joining the one from Fulham by way of Hyde Park and Edgware Road. From Portland Road this main runs easterly, nearly parallel with the 24-inch main from Shoreditch above mentioned, to the 48-inch main from Beckton in the Goswell Road. A third 24-inch main runs from the works north-westerly to Chalk Farm. From the distributing-point near the Edgware Road, a 24-inch main runs up the Lisson Grove to St. John's Wood Road, and thence across Edgware Road in a westerly and north-westerly direction to Kilburn Park, where it joins a similar sized main from the Kensal Green works.

From the Kensal Green works, a 30-inch main runs southward up Ladbroke Grove to Notting Hill, and thence eastward to Notting Hill Gate. From the same works a 24-inch main runs a little westerly of the 30-inch main to Notting Hill Gate, thence west of Kensington Gardens to High Street, Kensington, and thence westerly to Russell Road. At the junction of the Kensington Road with the Earl's Court Road, this main turns south-westerly, and runs almost straight to the Fulham works. A second, 24-inch main runs from Kensal Green to the Edgware Road at Kilburn.

From the Fulham works, three 36-inch mains branch in a north-easterly direction. The most northerly runs through the New Brompton Road and Hyde Park to Edgware Road; the second runs along King's Road, Chelsea, and Sloane Street, joining the first at Knightsbridge. The third runs along the Thames Embankment to Pimlico, and thence along Gloucester Street to Horseferry Road.

From Horseferry Road, a 36-inch main joins that from the Fulham works in Sloane Street, and thence runs parallel with another main of the same dimension across Hyde Park to Edgware Road.

From the storeage works of the late London Gas Company at Battersea, a 36-inch main runs north-easterly south of the Thames to Nine Elms; thence by the Thames to Church Street, Lambeth, a 24-inch main runs northward, crossing the Thames, to Pimlico.

From the Nine Elms works, a 24-inch main crosses the Thames to Pimlico, and proceeds westerly up St. George's Street. At the north end of Vauxhall Bridge, a branch of this main runs northerly along the Thames Embankment and Whitehall to Charing Cross, thence by the Strand to Fleet Street.

Existing Arrangement of Testing-Stations.

The Bromley works have allotted, for the purpose of testing the gas manufactured thereat, a station situated in Devons Road, Bow, about ½ mile from the gas-works. The gas to be tested is drawn from a 48-inch main, which does not supply any part of the locality, as it is situated in the district of the Commercial Gas Company. The gas made at these works is also tested at the Hornsey Road testing-place. The gas made at the Bow Common works, which are situated in the Commercial Gas Company's district, is tested at Aldgate (one of the testing-places under the control of the City of London), and situated about 2½ miles from the works. The gas made at the Shoreditch works (late Independent) is tested in the Kingsland Road, about ½ mile distant in a southerly direction. The gas made at the Haggerston works (late Imperial) is tested at Dalston, about a mile northerly. The gas from the St. Pancras works is tested at Camden, about a mile distant north-westerly. The gas from the Kensal Green works is tested at Ladbroke Grove, about ¾ mile distant southerly. The gas manufactured at Fulham is tested only three times a week at Carlyle Square, Chelsea, about a mile distant easterly. The gas manufactured at the Nine Elms works (formerly the London Company's) is tested at the same station as the above on the alternate three evenings per week; and also on the south side of the river, at Lambeth Road. The gas from Pimlico is tested at Westminster, about ¾ mile distant. The Beckton gas is tested at two of the City stations—viz., Cloth Fair and Salisbury Square—as well as at the Council's stations at Spring Gardens, at George Street, Euston Road, and Grove Gardens, St. John's Wood. The gas received from Beckton, and stored at Bromley, Fulham, Westminster, Nine Elms, St. Pancras, and Bow Common, is tested at the same stations as the gas manufactured at those works. Thus, while there are three stations in the City, there are twelve stations for that portion of the Metropolitan area supplied by The Gaslight and Coke Company outside the City.

From this description of the system of mains of The Gaslight and Coke Company and the position of the testing-places, it is obvious that the gas of any particular works is by no means confined to the district in which it is manufactured, and that it is not certain that a sample of gas tested on one of the special mains, such as that in Ladbroke Grove, or the one leading from St. Pancras to Chalk Farm, can be taken as an average sample of the make at the works from which it purports to come. Formerly it was enacted that the testing-places should be not less than 1000 yards distant from the works; and the Gas Referees adopted the principle that the stations should be fixed on a trunk main issuing from the respective works. The decisions of the Referees during later years, however, point to an intention to reverse the old system, and to appoint testing-places in the districts where the gas is consumed rather than on a trunk main—doubtless with the idea that, if the gas is supplied of the proper quality in those situations, it is not likely to be inferior immediately in proximity to the works.

South Metropolitan Gas Company.

The gas supplied by the South Metropolitan Gas Company is manufactured at six different works, situated at East Greenwich, Vauxhall, Old Kent Road, Rotherhithe, Greenwich, and Bankside. The daily average make of gas at the East Greenwich works is 10 million cubic feet; at Vauxhall, 9 millions; at Old Kent Road, 9 millions; at Rotherhithe, 4 millions; at Greenwich, 3 millions; and at Bankside, 1,200,000 cubic feet. The total average daily make of the Company is therefore upwards of 36 million cubic feet.

The distribution of gas from the East Greenwich works is effected by means of a new main along Blackwall Lane and Marsh Lane to the Greenwich and Woolwich Lower Road, whence the gas travels in an easterly direction to Woolwich and Plumstead.

From the Vauxhall works, four mains distribute the gas made thereat. One runs south-easterly by Wandsworth Road to Wandsworth Common; the second runs through South Lambeth to Clapham Road, there joining a main from Kennington distributing-station to Clapham Common; the third and fourth mains run easterly to the Kennington distributing-station.

The distribution of gas from the Old Kent Road works is effected by three mains. The first branches north-westerly along the Old Kent Road and the New Kent Road to the Elephant and Castle tavern, thence southward to Camberwell, whence branches run to Balham, Streatham Common, and Lower Norwood; the second runs almost due south to Peckham, thence along Rye Lane to Forest Hill and Lower Norwood. At Peckham a short branch runs to Dulwich. Near the works, a short branch leaves the main and runs southerly to Queen's Road and Rye Lane, and another proceeds westerly to Peckham Road.

The Rotherhithe works have two mains. The first runs by the River Thames along Tooley Street to London Bridge, and thence back through Bermondsey to Rotherhithe, where it meets the second main from the works, and proceeds south-easterly to Deptford and Brockley.

The Greenwich works have only one trunk main to the holder station, whence the gas is distributed easterly through Greenwich, south-easterly to Blackheath, westerly to Eltham, Mottingham, and Burnt Ash, and southerly to Rushey Green.

The Bankside works are supposed to send all the gas made there to the Kennington holders. From the Kennington distributing-station, three mains convey the gas to the consumers. The first runs to Southwark Street, the second to Newington, and the third runs down Clapham and Camberwell New Roads.

The testing-places appointed for testing the gas supplied by the South Metropolitan Gas Company are situated as follows: For the Peckham works, at Hill Street, about ¾ mile distant southerly; for the Vauxhall works, at Bedford Road, Clapham, about 1½ miles distant; for the Rotherhithe works, at Tooley Street, about 1½ miles distant; for the Greenwich works, at Lewisham, over 1 mile distant, and at Burrage Road, Plumstead, 4 miles distant, for the East Greenwich works; for the Bankside works, at Blackfriars Road, about 1 mile distant.

Commercial Gas Company.

The average daily quantities of gas manufactured at the Commercial Gas Company's three works are as follows: At Stepney, 1,700,000 cubic feet; at Wapping, 1,400,000 cubic feet, and at Poplar, over 2,500,000 cubic feet—giving a total average daily manufacture exceeding 5,600,000 cubic feet.

The gas supplied by the Company is manufactured at three works—viz., Stepney, Wapping, and Poplar. The bulk of the gas made by the Company is consumed on the westward or City side of the Regent's Canal, on the banks of which the works at Stepney are situated. These works have three diverging trunk mains—the first running easterly to Poplar, the second going west to Whitechapel and the Commercial Road, and the third south to the Isle of Dogs. The Wapping works have two mains—the first running westward by the river to the Tower, the second northward to St. George's Street and Cable Street. The Poplar works have three mains extending from them—one going to the East India Docks; one north, to Bow Road, whence a branch runs to Old Ford; and one west by Bow Common and St. Paul's Road to Stepney, which latter is the same as the eastward main from those works.

Quality of Gas Supplied.

With reference to the illuminating power of the gas supplied to the neighbourhood of Mile End Old Town and the parish of St. Luke, I beg to submit the following for the information of the Committee: Since 1884, I have, at almost each meeting of the Committee, called attention to the results obtained in the examination, by means of the portable photometer, of the gas supplied to the public generally, at Board schools, fire brigade stations, and private houses, and shown that the illuminating power of the gas supplied to these places was considerably below that supplied to the official testing-places. But as these tests have not been performed at places specified in the Notifications of the Gas Referees, the Council are not empowered to press for penalties, although they are as carefully made and as accurate as those obtained at the twenty official testing-places. [Accompanying the report was a map indicating by coloured squares the results of such tests made during the ten years ending Dec. 31 last; and showing that in 58·6 per cent. of cases the illuminating power was below the statutory standard of 16 candles. Particulars as to these and th official testings are given in Tables V. and VI.]

The concluding portion of the report deals with the testing of gas in the Commercial Company's district, and in the parish of St. Luke by the portable photometer. In the ten years ending Dec. 31 last, the gas of the Commercial Company was tested on 91 occasions at other places than the official testing-stations; and the illuminating power was found to vary between 17·4 and 14·7 candles. Mr. Dibdin thinks that, as three-sevenths of the gas supplied by the Company is manufactured at their Poplar works, a third testing-station is highly desirable. With regard to the illuminating power of the gas supplied to St. Luke's and the neighbourhood, Mr. Dibdin says that, during the

TABLE V.—*Results of Tests made within the Areas Supplied by the Three Gas Companies during the Period from 1884 to 1893 inclusive.*

Year.	The Gaslight and Coke Company.								South Metropolitan Company.							Commercial Company.				
	Illuminating Power in Candles.						Total No. of Tests.	Average Illuminating Power.	Illuminating Power in Candles.					Total No. of Tests.	Average Illuminating Power.	Illuminating Power in Candles.			Total No. of Tests.	Average Illuminating Power.
	Above 16.	Between 15 and 16.	Between 14 and 15.	Between 13 and 14.	Between 12 and 13.	Between 11 and 12.			Above 16.	Between 15 and 16.	Between 14 and 15.	Between 13 and 14.	Between 12 and 13.			Above 16.	Between 15 and 16.	Between 14 and 15.		
1884. .	19	7	4	..	..	..	30	15·9	7	4	..	..	..	11	16·3	2	1	..	3	16·0
1885. .	42	16	..	..	..	..	58	16·2	4	5	1	..	..	10	15·7	13	5	2	20	16·2
1886. .	26	32	4	..	..	..	62	15·8	..	4	..	..	..	4	15·7	14	3	..	17	16·4
1887. .	14	3	..	..	..	..	17	16·4	17	24	2	..	..	43	15·7	5	5	..	10	16·0
1888. .	37	25	..	..	..	..	62	16·1	6	11	1	1	..	19	15·6	..	..	..	..	..
1889. .	36	11	..	..	..	..	47	16·3	7	14	3	1	1	26	15·3	8	3	..	11	16·3
1890. .	37	14	2	..	..	..	53	16·2	10	17	5	2	..	34	15·4	..	..	..	..	..
1891. .	45	45	11	..	..	..	101	15·8	13	30	14	3	..	60	15·4	2	4	1	7	15·7
1892. .	39	61	10	..	..	2	112	15·6	14	28	19	8	..	69	15·2	5	5	1	11	15·8
1893. .	28	59	22	6	3	1	119	15·3	3	22	16	19	10	70	14·3	2	6	4	12	15·3
Total .	323	273	53	6	3	3	661	15·8	81	159	61	34	11	346	15·2	51	32	8	91	16·0

TABLE VI.—*Comparison of the Average Results of the Official Tests and those made by Means of the Portable Photometer.*

Year.	The Gaslight and Coke Company.		South Metropolitan Company.		Commercial Company.	
	Yearly Average of Tests at Official Testing Stations.	Yearly Average of Tests with Portable Photometer.	Yearly Average of Tests at Official Testing Stations.	Yearly Average of Tests with Portable Photometers.	Yearly Average of Tests at Official Testing Stations.	Yearly Average of Tests with Portable Photometer.
	Candles.	Candles.	Candles.	Candles.	Candles.	Candles.
1884 . .	16·7	15·9	16·6	16·3	16·8	16·0
1885 . .	16·7	16·2	16·6	15·7	16·8	16·2
1886 . .	16·7	15·8	16·5	15·7	16·8	16·4
1887 . .	16·6	16·4	16·4	15·7	16·7	16·0
1888 . .	16·6	16·1	16·3	15·6	16·6	..
1889 . .	16·5	16·3	16·3	15·3	16·5	16·3
1890 . .	16·5	16·2	16·3	15·4	16·3	..
1891 . .	16·4	15·8	16·4	15·4	16·4	15·7
1892 . .	16·4	15·6	16·3	15·2	16·3	15·8
1893 . .	16·3	15·3	16·4	14·3	16·3	15·3
Average .	16·5	15·8 (661 tests.)	16·4	15·2 (346 tests.)	16·6	16·0 (91 tests.)

same period, the gas was tested by the portable photometer at 99 places within a radius of about a mile from the centre of the parish, with the result that the illuminating power was found to be below the prescribed standard on 74 occasions—varying between 17·6 and 11·4 candles. Mr. Dibdin drew the Committee's attention to this state of things in March, 1890; with the result that some correspondence on the matter took place between the Council and the Gas Referees. The latter communicated with the Gas Company thereon; and requested them to secure a house near the crossing of Gerrard Street and Essex Street for the purpose of establishing an additional testing-place. But this has not been done. At the Carlyle Square testing-place, the gas from the Nine Elms and Fulham stations of The Gaslight and Coke Company cannot, under the existing arrangements, be tested on the same evening. Mr. Dibdin considers that the time has come when tests should be made of the gas supplied from both works on each day; and he recommends the Committee to urge the Gas Referees to modify their Instructions to this end. With respect to the south side of the Thames, Mr. Dibdin says the gas supplied to the parishes of Rotherhithe and Deptford is not protected by a testing-station. In the district east of the Tooley Street station, north of the Old Kent Road and west of Greenwich Hospital, 89 tests were made with the portable photometer during the past ten years, and in only 10 of them was the gas above the prescribed standard of 16 candles. He points out that the area thus included is large, and the consumption great; while the average illuminating power of the gas, as shown by the tests, is only 15 candles.

Mr. Dibdin closes his report with the following remarks: From the foregoing, it appears that the 53 million cubic feet of gas made daily by The Gaslight and Coke Company are tested at fifteen stations; that the 36 million cubic feet made by the South Metropolitan Gas Company are tested at six stations; and that the 5½ million cubic feet of gas made by the Commercial Gas Company are tested at two stations. The ratio of gas made to testing-stations is therefore: The Gaslight and Coke Company, 3½ millions; the South Metropolitan Company, 6 millions; and the Commercial Company, 2¾ millions. From these results, it would seem that, make for make, the gas supplied by The Gaslight and Coke Company and the Commercial Gas Company is equally tested; but that the gas supplied by the South Metropolitan Gas Company is most inadequately examined. Undoubtedly this is so. In view of the fact that nearly one-half of the gas made by the Commercial Company is supplied from the works at Poplar, for which no testing-place is provided, it is equally obvious that further protection is needed in that case. Summarizing the suggestions contained in this report, I recommend as follows:—

(1) That The Gaslight and Coke Company be requested to comply without further delay with the prescription of the Gas Referees respecting a testing-station at Gerrard Street, N.

(2) That the Gas Referees be requested to prescribe an additional testing-station for the purpose of more particularly testing the gas supplied from the Poplar works of the Commercial Gas Company.

(3) That the gas supplied from both the Fulham and Nine Elms works of The Gaslight and Coke Company be tested daily at the Carlyle Square gas-testing station.

(4) That the Gas Referees be further asked to prescribe two testing-stations for the purpose of testing the gas supplied by the South Metropolitan Gas Company to the districts of Rotherhithe, Deptford, and Greenwich, as the present nearest stations at Tooley Street and Lewisham are obviously inadequate for the purpose.

NOTTINGHAM CORPORATION GAS SUPPLY.

Annual Reports of the Committee and Engineer.

At the Meeting of the Nottingham Town Council on Monday last week—the Mayor (Alderman Pullman) presiding—the annual reports of the Gas Committee and their Engineer (Mr. W. R. Chester) for the year ending March 31 last were presented.

Dealing first with the report of the Committee, it stated that the past winter had been one of exceptional mildness, accompanied by a remarkable absence of fog and an unusual proportion of sunshine. As a consequence, the consumption of gas had materially fallen off; being 1,391,753,100 cubic feet, against 1,402,605,200 cubic feet in the previous year, or a reduction of 10,852,100 feet. The year, the Committee remarked, had been one of considerable anxiety to all large consumers of coal, in consequence of the long continued suspension of work at the collieries during the autumn. Without in the least pretending to any special forethought in the matter, the Committee mentioned that they had gradually accumulated a stock of coal almost sufficient to carry them over the stoppage—at least, sufficient to prevent any serious inconvenience to the town; and there would have been no loss, except that they deemed it necessary, as a matter of precaution, to make a few purchases from the Durham district towards the end of the stoppage. The net profit for the year was £21,855, as against £24,048 in the preceding year, or a decrease of £2193. Anticipating a successful year, the Committee took the opportunity of renewing a number of retort-settings at the Basford Gas-Works, replacing them with new settings on the regenerator principle, embodying all the latest modern improvements. The cost of the renewal had been paid out of revenue; and a considerable saving would be effected to the future working. Improvements in plant had also been carried out at the Giltbrook chemical works. The rebuilding of the old works at Eastcroft, they also stated, had been completed. It was most fortunate that it had been decided to take this step, as, upon pulling down the old works, it was found that the girders over the tar and liquor cisterns, on which they rested, were so eaten away by corrosion that, before long, the whole building would probably have collapsed, and might have been attended with serious loss of life.

Mr. Chester's report on the works and manufacturing operations commenced with the statement that the general efficiency of the plant at the various works had been fully maintained during the past year. The renewals and additions undertaken in 1892, at the Eastcroft works had been completed, except that portion of the work connected with the enlargement of the gasholders. The large building containing purifiers, engines, boilers, station-meters, and governors, was completed in the spring; and after inspection by the Committee,

was put into operation on March 1 last. Two of the four gasholders had been finished, and put to work; a third would be completed early in the autumn; and the last one, it was expected, would be ready for use before the end of the year. The completion of this portion of the work had been somewhat delayed, owing to difficulties arising from the large volumes of water met with in the substratum of the gasholder tanks. Numerous springs continued to boil up through the puddle of the interior of the tank for several months after the level of the water outside had been lowered to the required depth; and wherever these springs penetrated the puddle, they left behind a core of sand, forming channels through which the water escaped when the tanks were refilled. The discovery and stoppage of these leaks took up considerable time, and caused delay in the completion of the work. The distributory plant had continued to receive careful attention; and there was a gratifying diminution in the loss of gas from leakage. Further enlargements were being carried out this year which, it was expected, would still further diminish the loss from this source. The average illuminating power of the gas for the year was 18·64 candles; and the sulphur compounds were kept down to 16·20 grains of sulphur per 100 cubic feet of gas. Regarding the distribution department, the total mileage of mains was 280·09; there having been 2·39 miles added to the canalization during the year. The number of meters fixed to March 31 (including 322 lamp meters) was 38,732; being an increase of 411 meters on the previous year. Of these, 36,614 belong to the Gas Department, and 2118 to the consumers. The adoption of the prepayment, or "penny-in-the-slot" meters, by small consumers, had continued to increase; and at the end of the financial year, there were 1321 of these meters in operation, giving great satisfaction. In the course of the year, 1039 new gas services were laid, against 1297 in the previous twelve months. The application of gas for trade and domestic purposes, other than for lighting, continued to increase. There were at present in use about 3300 cooking-stoves, 4000 fires, and 238 engines, besides a very large number of other appliances of almost every description. Of the 3300 cookers in use, 2945 were rented from the department. The amount of coal carbonized during the year was 94,003 tons; and cannel, 51,566 tons. The estimated quantities of residuals made were: Coke and breeze, 87,336 tons (exclusive of 818 tons of unsaleable cannel coke); tar, 1,851,401 gallons; and ammoniacal liquor, 3,722,068 gallons. The revenue account showed that the total income was £232,322; and the total expenditure, £164,809—the balance being £67,512.

Alderman J. BARBER, Chairman of the Committee, in submitting the reports, said he trusted the Council would consider it satisfactory that, notwithstanding the extraordinary coal crisis, they were able to present a statement which only showed a diminution of £2000 upon the usual profits; and this £2000 was really not in consequence of the coal strike, but chiefly due to the large amount they had spent out of revenue for renewals, and to an extent to the increased price of coal.

Alderman FORD seconded the motion, which was adopted.

Gas v. Steam Power.—Messrs. R. Dempster and Sons, Limited, of Elland, have replaced all their steam-engines with gas-engines. They have now at work four gas-engines by Messrs. Crossley Bros., Limited, indicating 120-horse power. After making all allowances for interest, &c., it is expected that a considerable saving will be effected by the alteration. A smaller boiler has been fixed for working the steam-hammers, and for testing exhausters, steam-pumps, and steam-engines.

Increase in the Price of the Electric Light at Morecambe.—As from the 1st inst., the charges for the electric lighting service at Morecambe, as furnished by the Morecambe Electric Light and Power Company, Limited, have been increased as follows: For an 8-candle lamp, from 10s. to 12s. per annum; for a 16-candle lamp, from 20s. to 24s. per annum; and for a 32-candle lamp, from 40s. to 48s. per annum. In the notice intimating the advance, the Secretary of the Company (Mr. J. Jowett) says that "the excessive and unjustified use of the light by many consumers, combined with the cost of production, has compelled the Directors to adopt this course to ensure an adequate return on the shareholders' capital." The action of the Company is condemned by a writer in a local paper, who says it proves that somebody's word has proved to be unreliable in regard to the cheapness of the electric light. He thinks if the Gas Company were now to "step into the breach," and reduce the price of gas, they would be doing a good stroke of business.

The Proposed Extension of the Sowerby Bridge Gas-Works.—At the monthly meeting of the Sowerby Bridge Local Board last Wednesday, a long and animated discussion took place with regard to the proposed enlargement of the gas-works. Mr. Scholefield proposed the rejection of the principal minutes of the Gas Committee dealing with the matter. He pointed out that, in lieu of the scheme at first advocated by the Committee, a smaller one had now been decided upon—viz., to convert No. 2 gasholder into a three-lift one. The way in which this had been brought about was, he contended, unfair. Quotations for doing the work were invited; and among other tenders was one from Messrs. Clayton, Son, and Co., of Leeds, who offered to do the work for £962. The Committee came to an understanding that, if Messrs. Clayton would reduce their offer to £900, they should be given the work; and the firm agreed to this proposal. He maintained that the arrangement was an illegal one, as the Committee afterwards advertised for tenders in the local papers, having promised Messrs. Clayton the work for £900. He asked the Clerk whether the Committee could enter into a compact to give a contract to a firm before tenders were advertised for; and if such a contract was carried out, could it be legally contested by any ratepayer? The Clerk replied that, supposing Mr. Scholefield's facts to be correct, he should say it was not in accordance with the letter or the spirit of the Public Health Act. Mr. Helm seconded the amendment; and Mr. Wrigley confirmed the statement that Messrs. Clayton were promised the work for £900. Eventually the amendment was rejected; and the minutes were afterwards confirmed. It was also determined to make formal application to the Local Government Board for permission to borrow £20,000 for gas-works purposes.

THE LONDON COUNTY COUNCIL AND THE WATER COMPANIES' UNDERTAKINGS.

As already mentioned in our article on "Water and Sanitary Affairs," the London County Council, at their meeting on the 26th ult., had before them a report by the Water Committee on their proceedings in regard to the proposed acquisition of the London Water Companies' undertakings. The report set forth that, in accordance with the resolution of the Council of the 27th of February last, the Committee had entered into negotiations with the various Water Companies for the purchase of their undertakings, or one or more of them, at a fair and reasonable price, on the basis of a desire to purchase and willingness to sell. The attention of the Companies was drawn to the fact that, if satisfactory terms could not be mutually agreed upon, the Council would make an application to Parliament to determine in what manner and on what conditions a transfer of the undertakings should be arranged, provided that no monopoly right on the part of the Companies should be recognized. The Committee had already reported to the Council the replies of the several Companies to the letter inviting negotiations. In one or two instances, they simply declined to negotiate; and in others, while expressing their willingness to give consideration to any definite proposal that might be made, they nevertheless refused to accept the proposed basis, or to negotiate on that basis. They said they were continuing their correspondence with the Companies; but, in pursuance of the Council's resolution, it was necessary to make preparations for the application to Parliament contemplated therein. They therefore recommended as follows: "(1) That the Water Committee be authorized to make the necessary preparations for the introduction of one or more Bills in the next session of Parliament for the transfer to the Council, on the lines of the resolution of the Council of Feb. 27, 1894, of the undertakings of the Metropolitan Water Companies, or of such one or more of them as the Council may hereafter determine. (2) That the Water Committee, in conjunction with the Parliamentary Committee, be authorized to prepare the Bill or Bills." The consideration of these recommendations stood over.

At the meeting of the Council last Tuesday, the Water Committee presented another report, in which they stated that, since their previous report was agreed to, they had had an opportunity of further considering the subject, and had come to the conclusion that it would be better to go to Parliament for powers to acquire the properties of all the Companies, but to proceed by means of a separate Bill for each Company. With regard to the mode of preparing the Bills, it was clear that, instead of authorizing the Committee to prepare the Bill or Bills, it would be the proper course to associate a few of the members with the Parliamentary Committee in the matter. They accordingly recommended as follows: "(1) That eight separate Bills be prepared for the acquisition by the Council of the undertakings of the eight Metropolitan Water Companies. (2) That it be an instruction to the Parliamentary Committee, in conjunction with three members of the Water Committee, to prepare the Bills, with a view to their introduction in the next session of Parliament."

Mr. BEACHCROFT asked the Council whether, upon the information before them, they were in a position to give instructions to the Parliamentary Committee to prepare eight separate Bills for Parliament. What was the basis on which the purchase-price was to be calculated? He moved, as an amendment, that before the Council settle on the introduction of Bills for the acquisition of the undertakings of the eight Metropolitan Water Companies, the Council should determine what method was to be adopted for settling the purchase-money; and that the Water Committee be instructed to report upon the subject.

Mr. REED seconded the amendment.

The VICE-CHAIRMAN (Mr. Charles Harrison) said the conditions affecting the purchase-price in the case of each Company were different; and therefore, there must be separate Bills—in fact, it was nothing but the reiteration in Parliament by the Companies that they had a monopoly of the entire water supply of the Metropolis that had led to the idea that the powers for dealing with their acquisition should be all embraced in one Bill only. The resolution of the Council of Feb. 27 practically settled the terms of purchase; and the sooner the resolutions were passed, and the work relegated to the Parliamentary Committee to put into form, the better.

Mr. L. COHEN, M.P., supported the amendment.

Mr. BASSETT HOPKINS, the Chairman of the Committee, pointed out that they were only asking for sanction to prepare the Bills.

The amendment was negatived; and the recommendations of the Committee were adopted.

The Wakefield Rural Sanitary Authority and the Rothwell Local Board.—Among the minutes which the General Water Committee submitted, and which were approved, at the last meeting of the Wakefield Rural Sanitary Authority, was one to the effect that £40 13s. 2d. be accepted from the Rothwell Local Board "in settlement of the action *re* water supply." This has evidently some connection with the case reported on p. 441 of the JOURNAL for March 6.

The Oil-Gas Experiments at Bradford.—The Bradford Corporation Gas Committee decided last Friday that plant should be laid down at the Valley Road gas-works for the purpose of conducting an experiment with the "Peebles" system of utilizing oil and coal tar in the manufacture of gas. Some members urged that it would be desirable to defer experiments till those upon the oxy-oil system at present in process at Thornton Road were completed; but this was eventually overruled by a majority. The Committee approved a recommendation of a Sub-Committee on the subject, that the offer of Messrs. R. and J. Dempster, Limited, to fix the apparatus required for the experiment, subject to terms submitted, should be accepted; the estimated cost of the apparatus being £1218, upon which the Corporation are to pay interest at the rate of 7½ per cent. per annum until they shall determine whether or not to take over the plant. This proposal will come before the Council at their next meeting.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Mr. John S. Gibb, the Treasurer of the Edinburgh and Leith Gas Commission, has prepared his annual analysis of the accounts of the Commission for the past year. A very satisfactory feature of the accounts is the small sum for law and parliamentary charges, which amounted to only £245, and of which all that was required for accidental damages was £47 15s. This shows very careful management. The gross cost of gas was £180,862, as compared with £210,625 in the preceding year—a difference of £30,000, of which £25,000 was due to the reduced price for coal. A saving of £1200 was effected upon repairs and maintenance, and of nearly £4000 upon rates and taxes. The gross cost amounted to 27s. 4·88d. per ton of coal carbonized, as against 31s. 10·84d. in the preceding year; being 2s. 7·13d. per 1000 cubic feet of gas made, and 2s. 10·14d. per 1000 feet of gas sold. Coke realized £4894, as compared with £3966; waste lime, £110, as compared with £52; and tar, £17,905, as compared with £10,941—the total sum received for residuals being £22,910, as against £14,959. The return from residuals was 3s. 5·66d. per ton of coal carbonized; 3·94d. per 1000 feet of gas made; and 4·32d. per 1000 feet of gas sold. The net cost of gas was £157,580, as compared with £195,351. The net cost per ton of coal carbonized was 23s. 10·55d.; per 1000 cubic feet of gas made, 2s. 3·12d.; and per 1000 cubic feet sold, 2s. 5·75d. The revenue from gas was £224,982; and was 34s. 1·12d. per ton of coal carbonized, 3s. 2·72d. per 1000 feet of gas made, and 3s. 6·47d. per 1000 feet sold. In the preceding year, the revenue from gas was £245,036—the price of gas having been higher; and was 37s. 1·39d. per ton of coal carbonized, 3s. 7·24d. per 1000 feet of gas made, and 3s. 11·72d. per 1000 feet sold. The yield of gas was 1,394,287,000 feet, from 131,980 tons of coal, or at the rate of 10,564 cubic feet per ton; as compared with a yield of 1,360,049,000 cubic feet from 132,038 tons in the preceding year, or at the rate of 10,300 cubic feet per ton. Gas sold amounted to 1,262,610,000 cubic feet, as compared with 1,223,476,600 feet. Gas unaccounted for amounted to 8·83 per cent., as against 9·394 per cent. The average illuminating power was 24·91 candles, as compared with 25·59 candles. These figures speak for themselves, and require no comment.

Hamilton now possesses the distinction of having gas at the lowest figure at which it is sold anywhere in Scotland; the Police Commissioners having reduced the price this week from 2s. 11d. to 2s. 1d. per 1000 cubic feet, and abolished meter-rents. I am mistaken if it is not also, relatively, the lowest price charged for gas anywhere in the United Kingdom; because, the price being 1d. per candle, it is equal to 1s. 4d. per 1000 cubic feet for 16-candle gas. Mr. Ewing, since he became Gas Manager at Hamilton, has worked wonders; but it is not to be forgotten that he receives able support from Bailie Brown, the Convener of the Gas Committee. The results of the working for the month of June show an average yield of 10,558 cubic feet of gas, and of 77 gallons of tar and liquor per ton of coal carbonized; and that the gas, of 25-candle power, delivered into the holder, cost 6¾d. per 1000 cubic feet. The return for tar, liquor, and coke was at the rate of 6s. 11½d. per ton of coal. During the past 3½ months, the yield of gas per ton of coal was at the rate of 10,490 cubic feet, and that of tar and liquor 76·7 gallons; while the fuel account was 13 per cent. In the same period of 1891, there were 1368 tons of coal carbonized, which yielded 10,918,000 cubic feet of gas, and 73,550 gallons of tar and liquor; while this year 1357 tons of coal were carbonized, from which the yield was 14,226,200 cubic feet of gas, and 104,146 gallons of tar and liquor. Bailie Brown, in submitting the estimates for the current year, said it was anticipated that the total income would be £12,076, and the total expenditure £6952; leaving a balance of £5123. To abolish meter-rents would mean £150 of a reduction in the revenue; and to reduce the gas to 2s. 1d. per 1000 cubic feet, a reduction of £2625—a total estimated reduction of £2775. Allowing £500 as interest on capital, £1000 for depreciation, and £50 as an addition to the Gas Manager's salary, they had £798 left to account of a reserve fund. He expected that this amount would be much larger. Mr. H. S. Keith, who is "the old man of the sea" in the Commission, took exception to Bailie Brown's proposals. He thought they should allow the suggestion of reducing the price of gas to lie on the table for a month; and that the figures which had been submitted to them gave a most rosy view of their position. He was afraid they would be left without a balance, and considered that at least £1000 should be set aside for renewals, in addition to £1000 for depreciation. Mr. Keith should surely know how unwise his proposition is, without its being pointed out to him. The total amount borrowed on the Hamilton Gas-Works was £41,885; and of that sum £26,535 has been repaid, leaving £15,350 as the total indebtedness of the Corporation in respect of the gas undertaking. To set aside £2000 a year for renewal and depreciation, would mean that in less than eight years the gas undertaking would be in the fortunate position of having no capital account, unless extensions were meanwhile required. This would, of course, be a happy consummation; but when they are able to sell gas at 2s. 1d. per 1000 cubic feet, there is abundance of reserve, in the way of raising the price, to provide for renewals or extensions. In the meantime, the works are being maintained in good order; and the ordinary provision is being made for the future. Why, in these circumstances, there should be any cavilling at the management, I cannot understand, unless it arise out of disappointment at seeing the concern so well managed. The Police Commissioners do not sympathize with Mr. Keith; and they adopted Bailie Brown's report.

The strike of Scotch miners still continues, and, as I said last week, is likely to last until the holiday period is over. The leaders of the men are quite satisfied with the result, so far as their own followers are concerned. Whether they are satisfied with the outside support they are getting, is another matter. It would look as if they are not, because it has been resolved to increase the 6d. per week per man levy in England to 1s.; and at the same time it has been decided not to make any distribution to the men until some of the money derived from the increased levy comes in. That may be taken as an indication that the sum sent from England was disappointingly small. The first distribution is to be made next week. If it should prove to be less than the men have been led to expect, there will then be reason to expect defections from the ranks. There is a feature of the situation which looks as if a large section of the men are hanging loosely to the movement, in that, out of about 70,000 miners, only 30,000 belong to the Federation. They are all to share in strike money; and consequently it might be expected that the 40,000 who are out would at once join the Federation. They are not doing so; and the fact of their remaining out would seem to indicate that they are not enamoured of Federation ways. There is here an element of weakness, because non-Federation men will act for themselves; and they seem to be holding themselves outside for that purpose. I made a journey from Glasgow to Edinburgh the other night, and it was melancholy to see how the strike is affecting the trade of the busy district through which the railway passes. In the whole journey, so far as I could judge, only five large works are being kept going; whereas, in ordinary times, there would be several hundreds. Such a dislocation of work must entail very widespread misery; but that is not a factor which either the miners or their masters are likely to take into account in considering their position.

The Blairgowrie Gas Company have been able to increase their yield of gas per ton of coal from 8250 cubic feet in 1892-93, to 10,200 cubic feet last year. This has had the effect of reducing the net cost from 2s. 6d. to 1s. 4d. per 1000 cubic feet. Had it not been that the mills in the town were working on short time, there would have been a handsome profit on the year's working. As it was, the balance was £367.

The Bothwell and Uddingston Gas Company, to the management of which Mr. L. Hislop succeeded his late father, made a profit of £2508 last year, out of which they paid a dividend at the rate of 10 per cent., placed £590 to the reserve fund, and carried forward £1006. The output of gas was 26,106,000 cubic feet, as compared with 25,452,700 in the preceding year; and the loss from leakage was only 6·7 per cent. In proposing the adoption of the Directors' report, at the annual meeting of the shareholders, the Chairman (Dr. Goff) said that the business of the Company had been very satisfactory. Although 100 tons more coal had been carbonized, the expenditure on materials had gone down, while the revenue from residuals had gone up. The contracts for this year's supply of coal had been fixed on very satisfactory terms; and the Directors had therefore decided to reduce the price of gas from 3s. 9d. to 3s. 6½d. per 1000 cubic feet, and to abolish meter-rents. Mr. Hislop is to be congratulated upon the result of his first year's working.

The Brechin Gaslight Company, of which Mr. J. B. Terrace is Manager, have paid a dividend at the rate of 25s. per share—the same as for the past two years—and have continued the price of gas at 4s. 7d. per 1000 cubic feet. At present the Company are introducing the Peebles oil-gas process; and they expect to have it in use in two months' time. By its aid, it is anticipated that the illuminating power of the gas will be raised from 25 to 32 candles, and that the price of gas may be reduced. Leakage rose during the year from 7 to 15 per cent., on account, it is believed, of the recent introduction of a road-roller, and continuous heavy traffic in connection with the construction of the Forfar and Brechin Railway. The Directors are considering the propriety of making provision for the supply of electric light in the town.

The Lockerbie gas-rate case was decided by the Judges of the First Division of the Court of Session on Wednesday, before whom it had been taken on appeal by the defenders against Lord Low's decision in the Outer House. Lord Low decided that the imposition of the gas contingent guarantee rate was illegal, in respect that the Police Commissioners, in fixing the price of gas, had put it at an amount lower than would be required to meet all necessary outlays. Their Lordships of the First Division reversed that decision, and dismissed the action with expenses, on the ground that no case was stated on record to the effect that the Commissioners had not applied their minds to the consideration of raising the greatest amount of income in order to yield the highest return. At the same time, the Court expressed the view that they did not decide whether the Commissioners were entitled to proceed annually to impose this guarantee rate unless they had fairly complied with the provisions of the 41st section, which required them to fix the price of gas as nearly as may be estimated to raise sufficient to cover all the charges of manufacture and distribution and interest on borrowed money. This does not improve matters very much, because it leaves the whole question in dispute to be fought over again, in the event of the Police Commissioners resolving to reimpose the rate. Judges have a habit of deciding cases upon side issues, instead of facing legal points; and in this case that is what has been done. The action was not brought for the recovery of money, but to have a principle laid down; and their Lordships have disposed of the action without laying down the principle. It is so far satisfactory that the action has been decided, and that the costs of it will come out of the pockets of those who raised it; but it would have been much better had the law upon the subject been determined.

The difficulty at Kelso, with reference to the appointment of Mr. D. Wallace to the post of Manager of the Gas Company, is being settled in the way I suggested last week. After a meeting of the Directors, to whom it was remitted to rescind Mr. Wallace's appointment, a deputation was sent to Mr. Wallace's employers, to see if an arrangement could be made with them. There seems to be no difficulty there; and Mr. Wallace has intimated that he will resign the gas managership on receiving compensation. The Directors who objected to him have the good sense not to oppose his getting compensation; and consequently all that remains to be done is to fix the amount. When that is arrived at the Directors will be free to consider applications for the post.

The Pitlochry Gas Company have paid a dividend at the rate of 5 per cent., with a bonus of 2½ per cent., for the past year, and have reduced the price of gas by 10d. per 1000 cubic feet; but it still remains as high as 7s. 6d. per 1000 feet. The Saltcoats Gas Company have paid a dividend at the rate of £6 13s. 4d. per cent., and have retained the price of gas at 3s. 9d. per 1000 cubic feet.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July 7.*

Sulphate of Ammonia.—The market is considerably firmer, although the movement in prices is not great. The reason of this inflexibility of values may be found in buyers' determination to keep off the market till the latest moment; they being no doubt alive to the serious danger of small stocks and an insignificant production, in view of the certain demand, and the sensitiveness of the market in consequence of the Scotch strike. The latter has resulted in a greatly reduced output from blast-furnaces, and is in part affecting some of the oil-works as well. £14 is again the current quotation; and makers, in many instances, will not accept this figure, in anticipation of an expected improvement.

LONDON, *July 7.*

Tar Products.—Very little new business is reported. There is a better feeling with respect to carbolic and cresylic acids; but pitch cannot be said to be quite so firm, and lower prices have been taken. Benzols are flat, and practically unsaleable. Solvent naphtha continues in brisk demand; and American orders for creosote and other tar oils has distinctly helped them. Values noted during the week are: Tar, 13s. 6d. to 18s. 6d. Pitch, 29s. to 31s. Benzols, 90's, 11d.; 50's, 1s. 2d. Solvent naphtha, 1s. 4½d. Creosote, 1⅜d. Creosote salts, 16s. Toluol, 1s. 6d. Cresylic acid, 1s. Crude benzol naphtha, 30 per cent., 5d. Carbolic acid, 60's, 1s. 8d. Anthracene, "A," 1s. 2d.; "B," 10½d.

Sulphate of Ammonia is in fair request at £14, less 3½ per cent. in all positions. Stocks are low; production is at a minimum; but buyers' requirements appear to be satisfied. Gas liquor is quoted at 11s. to 13s. per ton.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—As the gas-coal season gradually works through, there would seem to be a weakening tendency as regards price. With regard to some of the contracts placed early, as I have previously reported, advances of 6d. to 9d. were obtained upon the low figures of last year; but this has been gradually disappearing as contracts have been settled at a later period, and during the last week or so there has been some very keen competition to secure the contracts that have been concluded. In some cases, the prices have been quite as low as those which had to be taken last year; ranging from about 7s., or even a trifle under this in special cases, for the commoner qualities of screened gas coals, up to 8s. and 8s. 6d. for the best Arley screened gas coal at the pit mouth. This keenness of competition has probably resulted from the fact that one or two colliery firms who adhered to the understanding to hold out for a substantial advance upon the 1893 prices, finding themselves cut out, have been determined almost at any cost to secure contracts that remained to be settled; and this would seem to represent a complete break-up of any understanding with regard to the basis upon which tenders should be sent in. With regard to the general round coal trade, the position remains very much as reported recently. The increased activity in the shipping trade, owing to the strike of miners in Scotland, has helped to steady prices for inland sales, and there has been no further giving way; but apart from shipping orders only a very limited business is being put through, and stocks go on accumulating rapidly where collieries are not in a favourable position for booking shipping orders. At the pit mouth, best Wigan Arley remains at 11s. to 11s. 6d.; Pemberton four-feet and seconds Arley, 10s. to 10s. 6d.; common house-fire qualities, 8s. to 8s. 6d.; steam and forge coals, 7s. to 7s. 6d.; with ordinary steam coal for shipment now fetching 9s. to 9s. 3d. per ton, delivered at the ports on the Mersey. Supplies of engine fuel are generally plentiful in the market; and prices if anything a trifle easier. Common slack can be bought readily at 4s. 3d. to 4s. 6d.; medium sorts, 5s. to 5s. 6d.; with some of the best qualities still quoted at from 6s. to 6s. 6d. per ton, at the pit.

Northern Coal Trade.—There has been of late a better demand for coal; and as the supplies have been adequately large, the tonnage sent out by rail and sea has been heavy. Best Northumbrian steam coal is rather irregular in price, small lots for prompt delivery being quoted as high as 11s. 6d. per ton f.o.b.; but the great bulk of the coal is being delivered on contracts at about 10s. per ton. Second qualities are about 1s. less; and steam smalls are plentiful at 5s. per ton f.o.b. There has been a better inquiry for manufacturing coal; but there is a plentiful supply still. In gas coals, the demand is slightly better; but it is still inadequate to give full work to all the collieries. Some coalowners ask 8s. per ton f.o.b.; but large contracts are known to be in course of arrangement at about 7s. 3d. per ton. Smithy coals continue in fair request; but there is no alteration to record in the prices. In coke, a better inquiry prevails for local use and for the furnaces of the north-west; but the exports are still disappointing. The price generally quoted for export qualities varies from 13s. 6d. to 14s. 6d. per ton. Gas coke is in slightly larger production; but the output is still well taken up, and the stocks are limited. The coal trades, however, are in so restless a position, that fuel users should enlarge stocks now.

Scotch Coal Trade.—What trade there is in Scotland at present is nearly all in the sale of English coal, which is being offered in the central districts and in the neighbourhood of seaports at the low figure of 10s. per ton. Only a few hundred miners are at work in all Scotland; and thus it may be said that practically no coal is being raised. There are still some stocks left at collieries; but it is nearly all sold, and is rapidly disappearing. A great many public works are closed, and more are closing daily, on account of the cost of fuel. There are no market prices. Shipments, of course, show a decline. For the week they amounted to 79,580 tons—a decrease of 74,781 tons upon the preceding week, and of 81,470 tons upon the corresponding week of last year. For the year to date, the total shipments have been 3,597,418 tons—an increase upon the corresponding period of last year of 286,543 tons.

Electric Lighting at Whitehaven.—The Whitehaven Town and Harbour Trustees resolved last Tuesday to apply to the Local Government Board for permission to borrow an additional sum of £4000 for electric lighting purposes. The sum previously sanctioned was £14,000.

Transfer of the Goole Gas-Works.—The gas and water undertaking of the Goole Gas and Water Company was transferred to the Goole Local Board last Thursday. At a meeting of the Board, the seal was affixed to a temporary loan from the York City and County Bank for £79,150; and the agreement was ratified by the Directors of the Company.

New Electric Light Companies.—The Great Western Electric Light and Power Company, Limited, has been registered with a capital of £1000, in £10 shares; the Putney Electric Supply Company, Limited, with a capital of £1000, in £2 shares; and the Windermere and District Electricity Supply Company, Limited, with a capital of £50,000, in £5 shares.

Exhibitions of Gas Appliances.—Last week the Davis Gas-Stove Company, Limited, held exhibitions at Billericay and Chalford; Mrs. Hunter lecturing at the former, and Miss Hunt at the latter place.——From the 26th to the 29th ult., Messrs. W. Parkinson and Co. held a successful exhibition of their appliances at Southend, with the assistance of Mrs. Springthorpe as lecturer. Last week they had an exhibition in the Public Hall, Erdington, Birmingham; Miss Edith Sanderson giving practical demonstrations on cookery. In the present week they will be at Wellesbourne and Kineton, where Miss Rouse will lecture; and at Bourton-on-the-Water, where they will have the co-operation of Mrs. Marshall.——Last Tuesday an exhibition of gas appliances was held in the Victoria Hall, Aston, at which Mrs. Cox demonstrated the value of the "Main" cooker.——Messrs. R. and A. Main also held an exhibition at Cupar last week, with Miss Hunter as the lecturer.

The Assessment of the Redhill Gas Company's Works.—At the Surrey Quarter Assizes held at Kingston on Friday last, the Redhill Gas Company appealed against the assessment of their property in the parishes of Reigate and Nutfield. In the old list, the gross value for the Reigate parish was £3281; and the rateable value, £2412. On April 28 last, however, the Assessment Committee increased the gross value in the Reigate parish to £4200, and the net to £3200; and in the Nutfield parish to £145 gross and £100 net. Several well-known expert witnesses were called on both sides; and their examination was conducted by Mr. E. Boyle for the appellants, and Mr. Balfour Browne, Q.C., and Mr. Muir for the respondents. The result was that the appeal was allowed, with costs—the gross assessment in Reigate being reduced to £3500, and the net to £2500, and in Nutfield to £130 gross and £90 net. A report of the arguments and evidence (which were of an interesting character) will appear next week.

Electric Lighting of the Sea Front at Hastings.—On Saturday, the 30th ult., the completion of the electric lighting of the whole of the Sea Front of Hastings—from West St. Leonards to the Fish Market—by arc lamps, was celebrated by a banquet at the Eversfield Hotel, at which Mr. H. M. Baker (Chairman of the Hastings Electric Light Company, Limited) presided. Quite early in the proceedings (about 9.30) the electric light with which the banqueting-room had been illuminated went out, and the party were in darkness, with the exception of the light shed by the candles. It was stated that the failure was caused by some defect in the internal arrangements at the hotel, as the light was burning brightly outside. The gas-burners were lit pending the reappearance of the electric light, which came on again about 9.45, amid the hearty plaudits of the company, who had witnessed its disappearance with subdued laughter. Subsequently, the Mayor of Hastings (Alderman Tree), in proposing "Success to electric lighting," referred to the disappearance of the light during the dinner, and said it was rather singular that it should have failed at another public dinner in the town, and also when a demonstration was passing through the streets. He was almost inclined to think that the light had been turned off purposely. At the close of the banquet, the Mayor and his supporters went to the pier, and at 10.40 switched on the light, amid the cheering of a large number of spectators.

Another Fatality at the Blackfriars Electric Light Station.—We take the following from the current number of the *Electrician*: "We regret to record an accidental death at the Blackfriars transformer sub-station of the London Electric Supply Corporation. The four mains from Deptford enter by a small cellar under the sub-station, and are connected by omnibus bars and switches to the outgoing mains to London. The inner conductors alone are connected to the bare metal work of the switches, and the outers are all connected together by well-insulated cables; and, under ordinary circumstances, no serious shock can be obtained in this cellar, the floor of which consists of a rubber-covered platform on oil insulators. A leak had been discovered on one of the London mains; and this main was cut out by switches, and was tested. It was decided to connect a Deptford main on one side of the cellar to a London main on the other side by two plugs and a length of cable as a temporary expedient. The switchman, who was thoroughly familiar with his work, and who had been in the employ of the Company for five years, put the plug on to one of these mains, which, according to the strict rules of the Corporation was, while work was being done upon it, 'dead.' Thinking the plug might slip off, he used some binding wire to fasten it, and sent his mate for more. It is supposed that the loose end of the binding wire flicked against the 'live' omnibus bar about a foot above the plug, and that he thus received a shock, throwing him back. Unfortunately, he had left open a wooden bar protecting the terminal of the faulty main behind him, and this allowed his head to strike a live Deptford terminal and at the same time the faulty London main. A serious arc was struck—blowing the fuse at Deptford, and, of course, killing the unfortunate man. Of the two accidental causes, the use of binding-wire where a bit of string or spunyarn would have sufficed—if, indeed, it were wanted at all—seems to be the more important. No need is apparent; but this man, after five years' experience, must have had some reason. The general arrangement of the sub-station proper, its substantial switching gear, admirable cleanness, and orderliness show that both the Corporation and its staff have done, and do, all that is possible to carry out the work in the best possible manner."

Purchase of the Fareham Electric Lighting Works by the Local Board.—The Fareham Local Board have received a letter from the Electric Lighting Company, accepting an offer recently made by the Board to purchase their works for £5000, with an additional £1000 for the laying of the wires underground. Pending the application to the Local Government Board for permission to borrow the necessary loan, the Clerk (Mr. L. Warner) has been instructed to prepare the contract to carry out the purchase.

The Repayment of Electric Lighting Loans.—At the meeting of the London County Council last Tuesday week, the Finance Committee recommended a loan of £25,000 to the Vestry of Hampstead for electric lighting purposes, to be repaid in 25 years. The Vestry asked that the term of repayment should be extended to 42 years, as the Council had given their sanction to loans being repaid in this period for similar works by the Vestry of St. Pancras. The Committee expressed the opinion that the term of repayment should not exceed the life of the works upon which the money was to be expended. After a prolonged discussion, the opinion of the Committee was disregarded, and the request of the Vestry was acceded to.

The Position of the Manchester Water Supply.—At the meeting of the Manchester City Council last Wednesday, Alderman Clay inquired when they were likely to have water from Thirlmere. They had heard, he said, of fissures in the rocks and the side of a mountain moving; and he wished to know whether these things were going to delay the matter very much. Alderman Leech, Deputy-Chairman of the Committee, said it might possibly relieve the minds of some people, if he referred to their position in regard to the water supply. At the present time they required from 26 million to 27 million gallons per day for domestic and trade consumption, and about 13 million gallons for compensation; but, to be on the safe side, he would take the consumption in the one case at 28 millions, and in the other at 14 millions, and on that basis, they had in the reservoirs now at Woodhead and elsewhere close upon thirteen weeks' supply. This being so, they would see there was not any immediate apprehension of scarcity. At the same time, he must urge all the citizens not to be extravagant in the use of water. With reference to Thirlmere, it was a fact that the Committee could have given a supply some time ago had it been requisite; and he could assure the Council that it could be brought there within a week at any time.

Burnley Corporation Gas and Electricity Supply.—The Burnley Corporation departmental reports have just been issued; and they include that of Mr. J. P. Leather, the Gas Manager. He says that the make of gas shows an increase in the past financial year of 6,690,000 cubic feet, or 1·67 per cent. The largest consumption in one day was on Dec. 22 last—viz., 2,500,000 cubic feet, as compared with 2,363,000 cubic feet on Dec. 23, 1892, and 2,614,000 cubic feet on Dec. 24, 1891. The number of additional lamps put up during the past year was 32; making the total now in use 1788. The lamps were lighted 3483 hours, and consumed 35,200,000 cubic feet of gas. The total quantity of coal and cannel used was 45,902 tons, of which 11·68 per cent. was cannel. The cost was £36,840, or 16s. 0·6d. per ton, as against 14s. 3·7d. in the previous year; the increase being due to the high price paid for fuel during the coal stoppage. Worked out, the cost was 1s. 11d. per 1000 cubic feet of gas sold, as against 1s. 6·6d. the year before. Mr. Leather puts the total loss by reason of the coal stoppage at £6350. The average illuminating power of the gas was 17·72 candles; and the average amount of sulphur in it, 13·39 grains per 100 cubic feet. Mr. F. Thursfield, the Electrical Engineer, in his report says that the demand for the electric light has already reached, if not exceeded, the first expectation. There are 68 consumers with 4355 lights; and 15 more have signed forms to use the new illuminant. The cost of the light has been considerably reduced during the past six months, owing to the expiration of the incandescent lamp patents.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 86.)

Issue.	Share	When ex-Dividend.	Dividend & Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p. c.	**GAS COMPANIES.**				£ s. d.
590,000	10	12 Apl.	10½	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	,,	7½	Do. 7 p. c.	10	12—13	..	5 15 4
300,000	100	2 July	5	Australian (Sydney) 5 % Deb.	100	105–107*	−½	4 13 4
100,000	20	14 June	8	Bahia, Limited	20	9½—10½	..	15 3 10
200,000	5	11 May	6½	Bombay, Limited	5	5¼—5¾	..	5 13 0
40,000	5	,,	6½	Do. New	4	4—4½	..	5 15 6
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	223—228	..	5 0 10
180,000	,,	,,	8½	Do. New	100	168—173	..	4 18 3
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	210—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	110—113	..	4 8 6
320,000	20	29 Mar.	11¼	British	20	45—47	..	4 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21—22	..	5 4 7
51,510	10	,,	8½	Do. 7 p. c.	10	16—17	..	5 0 0
328,750	10	28 June	2	Buenos Ayres (New) Limited	10	5½—6*	..	3 6 8
200,000	100	2 July	6	Do. 6 p. c. Deb.	100	98–101*	..	5 18 10
150,000	20	28 Feb.	8	Cagliari, Limited	20	26—27	..	5 18 6
550,000	Stck.	12 Apl.	12½	Commercial, Old Stock	100	260—265	+3	4 14 4
165,000	,,	,,	9½	Do. New do.	100	192—197	+2	4 16 5
160,762	,,	14 June	4½	Do. 4½ p. c. Deb. do.	100	130—135	..	3 6 8
800,000	Stck.	14 June	13	Continental Union Limited	100	235—240	..	5 8 4
200,000	,,	,,	10	Do. 7 p. c. Pref.	100	210—215	..	4 13 0
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk	100	105—110	..	4 10 11
486,090	10	31 Jan.	11†	European, Limited	10	23½—24½	..	4 9 10
354,060	10	,,	11†	Do. Partly paid		16½—17½	..	4 14 3
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	7½	240—245	+3	4 17 11
100,000	,,	,,	4	Do. B, 4 p. c. max.	100	100—104	..	3 16 11
665,000	,,	,,	10	Do. C, D, & E, 10 p.c. Pf.	100	275—280	..	3 11 5
30,000	,,	,,	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	,,	,,	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	,,	,,	7	Do. H, 7 p. c. max.	100	177—182	..	3 16 11
463,000	,,	,,	10	Do. J, 10 p. c. Prf.	100	272—277	..	3 12 3
476,000	,,	,,	6	Do. K, 6 p. c. Prf.	100	167—172	..	3 9 9
1,061,150	,,	14 June	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	,,	,,	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	,,	,,	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	11 May	12	Imperial Continental	100	217—222	+3	5 8 1
75,000	5	14 June	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	109—111	..	4 10 1
541,920	20	14 June	5	Monte Video, Limited	20	13¾—14½	..	6 18 0
150,000	5	30 May	8	Oriental, Limited	5	5¾—6¼	..	6 8 0
60,000	5	29 Mar.	7	Ottoman, Limited	5	3¾—4¼	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1½—2	..	10 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—107	..	5 12 1
500,000	100	1 June	6	2nd Do.	100	95—100	..	6 0 0
150,000	10	26 Apl.	6	San Paulo, Limited	10	9½—10½	..	5 14 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	322—327	+2	4 14 9
1,350,000	,,	,,	12	Do. B do.	100	267—272	+2	4 8 3
260,000	,,	,,	13	Do. C do.	100	277—282	+4½	4 12 2
750,000	,,	17 Jan.	5	Do. 5 p. c. Deb. Stk.	100	156—160	+3	3 2 6
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	210—215	..	5 7 0
				WATER COMPANIES.				
746,011	Stck.	28 June	10	Chelsea, Ordinary	100	277–282*	+2	3 10 11
1,720,252	Stck.	12 Apl.	8	East London, Ordinary	100	225—230	..	3 9 7
544,440	,,	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	147–150*	+2	3 0 0
700,000	50	14 June	8½	Grand Junction	50	118—122	..	3 9 8
708,000	Stck.	28 Feb.	11½	Kent	100	295—300	..	3 16 8
1,043,800	100	28 June	9½	Lambeth, 10 p. c. max.	100	253–258*	..	3 13 7
406,200	100	,,	7½	Do. 7½ p. c. max.	100	206–209*	+3	3 11 9
330,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	370—375	+3	3 4 8
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	134—137	..	2 18 4
902,300	Stck.	14 June	6	S'thwk & V'xhall, 10 p. c. max.	100	165—170	+2	3 11 0
126,500	100	,,	6	Do. D 7½ p. c. do.	100	147—150	..	4 0 0
1,155,066	Stck.	14 June	10	West Middlesex	100	267—272	..	3 13 7

*Ex div.

† Next dividend will be at this rate.

GWYNNE & BEALE'S
PATENT GAS EXHAUSTERS AND ENGINES.

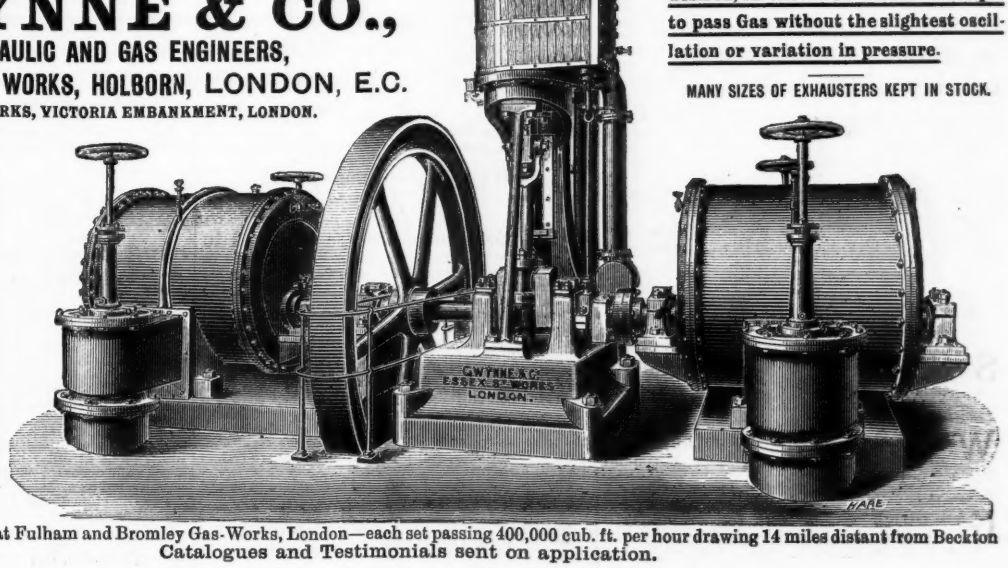
Telegrams: "GWYNNEGRAM, LONDON." Telephone No. 2698

GWYNNE & CO.,
HYDRAULIC AND GAS ENGINEERS,
BROOKE STREET WORKS, HOLBORN, LONDON, E.C.
Late ESSEX STREET WORKS, VICTORIA EMBANKMENT, LONDON.

They have completed Exhausters to the extent of 32,000,000 cubic feet passed per hour, which are giving unqualified satisfaction in work.

Makers of GAS-VALVES, HYDRAULIC REGULATORS, VACUUM GOVERNORS, PATENT RETORT-LIDS, STEAM, PUMPS for Tar, Liquor, or Water; CENTRIFUGAL PUMPS and PUMPING ENGINES, specially adapted for Water-Works, raising Sewage, &c.

Also GIRARD and other TURBINES, HIGH SPEED ENGINES, DYNAMOS, &c., &c., for ELECTRIC LIGHTING.



Their Exhausters can be made, when desired, on their New Patent Principle to pass Gas without the slightest oscillation or variation in pressure.

MANY SIZES OF EXHAUSTERS KEPT IN STOCK.

Exhausting Machinery at Fulham and Bromley Gas-Works, London—each set passing 400,000 cub. ft. per hour drawing 14 miles distant from Beckton
Catalogues and Testimonials sent on application.

OXIDE OF IRON.

O'NEILL'S Oxide has a larger annual sale in the United Kingdom than all other Oxides combined. Purity and uniformity of quality guaranteed. Pamphlet, "How to Purchase Bog Ore," to be obtained on application.
Gas Purification and Chemical Company, Limited, Palmerston Buildings, Old Broad Street, London, E.C.
JOHN WM. O'NEILL, Managing Director.

GAS PURIFICATION AND CHEMICAL COMPANY, LIMITED.

ANDREW STEPHENSON, Agent. All communications re OXIDE to be addressed to PALMERSTON BUILDINGS, E.C.

BRIN'S Oxygen Company, Limited, Westminster. ANDREW STEPHENSON, Agent.

WINKELMANN'S "VOLCANIC" CEMENT. Fire Resistance up to 4500° Fahr. In use in most Continental Gas-Works, and in more than 200 British Gas-Works. [See Advt., p. 115.]
ANDREW STEPHENSON, 182, Gresham House, Old Broad Street, LONDON, E.C. Telegrams: "Volcanism, London."

PORTER & CO., Gowts Bridge Works, LINCOLN, Engineers, Ironfounders, and Contractors for the erection of Gas-Works for, Towns, Villages, Mansions, Manufactories, Collieries, and Isolated Buildings, at home and adroad. Manufacturers of Retorts and Fittings, Condensers, Scrubbers, Purifiers, Valves, &c.; also of Girders, Wrought and Cast Iron Tanks, Iron Roofs, &c.
Telegraphic Address: "PORTER LINCOLN."

AMMONIACAL LIQUOR Wanted.
BROTHERTON AND CO., Ammonia Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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BROTHERTON AND CO., Tar Distillers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

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BROTHERTON & CO.
Offices: Commercial Buildings, LEEDS. Correspondence invited.

WANTED, a Situation as Meter Inspector or REPAIRER. Able to fix Meters. Five years' experience. First-class references.
Address J. MASTERS, 40, Regent Street, OLDHAM.

THE Assistant Engineer of two large Gas-Works on the Continent, making 900 million cubic feet per annum, is OPEN TO AN ENGAGEMENT. Speaks three languages.
Address No. 2406, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a Situation as Working Gas MANAGER. Good Carbonizer, and has a thorough knowledge of the Manufacture and Distribution of Gas. Also the Manufacture of Sulphate of Ammonia. Able to do all Fitting in and out of the Retort-House. First-class Testimonials for past management.
Address No. 2408, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

APPLICATIONS are invited from Travellers calling on Provincial Gas Companies to take up another COMMISSION. Only those having first-class References and giving full Particulars of present engagements need apply.
Address J. S. P., care of J. W. Vickers, 5, NICHOLAS LANE, E.C.

ABERTILLERY LOCAL BOARD.

APPOINTMENT OF WORKING GAS AND WATER MANAGER.

THE above Board will, at their Meeting to be held on Thursday, the 2nd day of August, 1894, proceed to the appointment of a person competent to undertake the duties of a WORKING GAS AND WATER MANAGER, under Supervision, at a Salary of £2 per week, with House, Coal, and Gas.

The person appointed will be required to have a thorough knowledge of the Manufacture and Distribution of Gas; also the Laying and Repairing of Water and Gas Mains, Service-Pipes, &c., and must be prepared to enter upon his duties on the 29th of September, 1894.

Applications, stating age, previous and present occupation, enclosing copies of testimonials (not exceeding three) of recent date, and endorsed "Working Manager," to be delivered at my Office not later than Four p.m., on Wednesday, the 1st of August, 1894.

Canvassing the members of the Board either personally or by agent, will be held to be a disqualification for the appointment.

By order,
JNO. ALEX. SHEPARD,
Clerk to the Board.

Town Hall, Tredegar,
June 30, 1894.

SMALL Gas Exhauster and Engine com- plete wanted.
BROTHERTON AND CO., Commercial Buildings, LEEDS.

CYANIDES.

WANTED, Particulars of manufacture from Gas Liquor and Spent Oxide. Communications treated confidential.
Mr. BROTHERTON, Commercial Buildings, LEEDS.

GAS COKE—2000 tons for immediate delivery in Trucks for Rail or Shipment.
Apply to the MANAGER, Gas-Works, CARDIFF.

JAMES LAWRIE & Co. supply Best SCOTCH CANNEL COALS, Best FIRE-CLAY RETORTS, BRICKS, TILES, and LUMPS; BOILER SEATING BLOCKS, FLUE COVERS, and SILICA BRICKS for SPECIAL FURNACE WORK; COKE BARROWS, BOGIES, and SMALL WAGONS.
Postal Address: 1, WHITTINGTON AVENUE, E.C.
Telegram Address: "EIRWAL LONDON."

W. C. HOLMES & CO., Huddersfield; AND 80, CANNON STREET, LONDON,
Contractors for Gas-Works complete, Makers of Gasholders, Purifiers, Scrubbers, Condensers, Retort Fittings, &c., Improved Valves, Engines, and Exhausters. Also for Collingwood's Regenerative Retort-Settings.
*** See Advertisement p. 111 of this Week's issue.
Cablegrams: "Ignitor London." Telegrams: "Holmes Huddersfield."

J. & J. BRADDOCK, Globe Meter Works, Oldham.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Address: "Braddock Oldham."

SULPHURIC ACID.

JOHN NICHOLSON & SONS, Chemical Works, Leeds, specially produce this ACID from BRIMSTONE, for making SULPHATE OF AMMONIA of high quality and *good* colour. Delivery in our own Railway Tank-Wagons or Carboys. Highest references and all particulars supplied on application.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

JOURNAL VOLUMES.

WANTED, Volumes of the Journal of GAS LIGHTING to form a complete set.
State Volumes for disposal and price to No. 2407, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

AMMONIA SATURATORS.

TO GAS ENGINEERS, SULPHATE OF AMMONIA MANUFACTURERS, ETC.

MESSRS. W. THOMASON AND SONS, Chemical Plumbers, Lead Burners, &c., 21, WESTON STREET, BOLTON, beg to call the attention of Gas Engineers and others to the fact that, having laid down New Plant of the most modern construction, they have now the most complete and best adapted Premises in Lancashire for the Manufacture of LEAD SATURATORS and all kinds of CHEMICAL PLUMBING, and will be pleased TO QUOTE for any kind of LEAD WORK or REPAIRS of any description. By employing first-class Chemical Plumbers only, they can guarantee to give satisfaction to any orders entrusted to them.
Messrs. W. THOMASON AND SONS have on hand, ready for delivery, a Solid Plate Lead Saturator, 5 ft. by 4 ft. by 4 ft., made from 1-inch Lead Plates for the sides and midfeather, and 1½-inch Lead Plates for the top and bottom, burned solidly together by an improved process; and they invite inspection of the same by Gas Engineers or others interested.
Please write for an Estimate before ordering elsewhere. Lead Burners sent out to repairs.

BETHESDA.

THE Bethesda Improvement Commis- sioners invite TENDERS for the supply of GAS COAL for a period of One Year, commencing from the 1st day of August, 1894, to the 31st day of July, 1895, to be delivered at the Bethesda Railway Station in such quantity and at such times as may be required.

The Coal must be of the best of its kind, well screened, and free from Bats, Pyrites, or other Impurities.

Parties tendering must give full information as to the Coal offered, and the Colliery from which they propose to supply; and the tenders to be sent to me not later than the 31st day of July, 1894.

The Commissioners do not bind themselves to accept the lowest or any tender.

R. BENJAMIN EVANS,
Clerk to the Commissioners.

Rachub, near Bangor,
July 4, 1894.

SOWERBY BRIDGE LOCAL BOARD.
(GAS DEPARTMENT.)

NO. 1.

THE Gas Committee are prepared to receive TENDERS for the supply of about 1200 yards of 18-inch CAST-IRON MAINS, and about 350 yards of 12-inch CAST-IRON MAINS and IRREGULARS, BRANCHES, TEES, &c.

Forms of Tender and Specifications can be obtained on application to the Engineer.

NO. 2.

TENDERS are required for a 12-inch and 18-inch GOVERNOR, with designs of same offered. They must include Bye-Pass, Valves, and Connections fixed complete; the Committee providing Foundations. Separate price required for each size.

Tenders to be endorsed "Gas-Mains" or "Governor," and to be addressed to the Chairman of the Gas Committee, Gas-Works, Sowerby Bridge, not later than July 21, 1894.

The Gas Committee do not bind themselves to accept the lowest or any tender.

JOHN MARSLAND,
Engineer and Manager.

Gas-Works, Sowerby Bridge,
July 6, 1894.

GAS PURIFICATION.

OXIDE OF IRON BOG ORE.

BALE & CO.'S Oxide of uniform quality, Sample and Price on application.
OXIDE PAINTS, OILS, SULPHURIC ACID, &c.
120 and 121, NEWGATE STREET, LONDON, E.C.
Telegrams: "BOGORE, LONDON."

OXIDE OF IRON.

FINEST Quality of Natural Bog Ore. Particulars and price, apply to Mr. T. L. ARCHER, 20, Fennel Street, MANCHESTER.

SADLER AND CO., LIMITED, MIDDLESBROUGH; ULVERSTON (BARROW); PORTSMOUTH; CARLTON; STOCKTON; 315, St. Vincent Street, GLASGOW; and 85, Water Street, NEW YORK. Tar Distillers, Manufacturers of all TAR PRODUCTS, ALIZARINE and other TAR COLOURS, BICHROMES, OXALIC ACID, ALKALIES, LIQUOR AMMONIA, AMMONIA SULPHATE, &c.
Head Office: MIDDLESBROUGH. Correspondence invited.

HYDRATED OXIDE OF IRON.

PREPARED from pure Iron
Two or three times as rich as Bog Ore.
Strong action on Sulphuretted Hydrogen.
To be used alone, but will increase activity of other Oxides.
Less than half the price of Bog Ore.
Can be lent on hire.
Write for tabulated results.
READ HOLLIDAY AND SONS, LIMITED, HUDDERSFIELD.

SPECIAL PAINT FOR GAS-WORKS.

JOHN E. WILLIAMS AND CO., VICTORIA PAINT WORKS, MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.
GAS PLANT CEMENT
FOR ALL LEAKAGES.

TENDERS are invited for 1200 tons of PELAW MAIN GAS COAL, f.o.b. Tyne.
Delivery as required between now and the 30th of September, 1895.

JAS. THOMAS,
Manager.

Gas-Works, Bodmin.

YSTRAD GAS AND WATER COMPANY.

THE Directors of the above Company invite TENDERS for the surplus TAR produced at their Gas-Works at Ystrad and Porth, Rhondda Valley, during the Twelve Months ending July 31, 1895.
Tenders to be sent to the Secretary's Office not later than Monday, the 23rd day of July inst., marked "Tar."

ARTHUR P. JAMES,
Secretary.

123, Queen Street, Cardiff.

BOROUGH OF ROTHERHAM.

TENDERS FOR GAS COAL.

THE Gas Committee of the Rotherham Corporation invite TENDERS for the supply of 14,500 tons of unscreened GAS COAL, delivered at the Gas-Works, Rotherham; and for 1700 tons of CANNEL, delivered at the Railway Station, Rotherham, during the ensuing Twelve Months.
Forms of Tender may be obtained on application to Mr. C. B. Newton, Gas-Works, Rotherham.
Tenders to be sent in to me not later than Wednesday, the 18th inst., endorsed "Tender for Coal."

By order,
H. H. HICKMOTT,
Town Clerk.

Council Hall, Rotherham,
July 6, 1894.

CORPORATION OF WEST BROMWICH.
(GAS DEPARTMENT.)

TO TAR DISTILLERS.

THE Gas Committee of this Corporation are prepared to receive TENDERS for the purchase of the surplus TAR made at their Albion Works, West Bromwich, for the period of One, Two, or Three Years from the 1st of July inst.
Forms of Tender, and Particulars as to terms of the contract, may be obtained upon application to the undersigned.
Sealed tenders, addressed to the Chairman of the Gas Committee, endorsed "Tender for Tar," to be sent to me not later than the 19th inst.
The Committee do not bind themselves to accept the highest or any tender.

By order,
THOS. HUDSON,
Secretary.

Town Hall, West Bromwich,
July 5, 1894.

TENDERS FOR TAR AND LIQUOR.

THE Directors of the Slough Gas and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR (or either) produced at their Works, for a term of One Year, from the 30th of June, 1894.
The Slough Branch of the Grand Junction Canal is available.
The estimated quantities to be produced are: Tar, 24,000 gallons; and Liquor, 20,000 gallons.
The Products must be removed from the Works in Tank-Carts.
Sealed tenders, stating price for Tar per barrel of 36 gallons, and prices for Ammoniacal Liquor per 1000 gallons of different strengths, at the Company's Works, and endorsed "Tender for Tar and Liquor," to be delivered on or before Tuesday, the 24th of July inst.
The Directors do not bind themselves to accept the highest or any tender.

ARTHUR THOMAS,
Secretary.

Slough, Bucks., July 2, 1894.

THE Cleator Moor Local Board invite TENDERS for supplying and erecting a complete SULPHATE OF AMMONIA PLANT capable of dealing with 5 tons of Liquor per day.

Endorsed tenders to be delivered to the undersigned on or before July 17, 1894.

HENRY ROTHERY,
Clerk to the Board.

Public Offices, Cleator Moor,
July 5, 1894.

OSWALDTWISTLE LOCAL BOARD.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1894.

The quantity of coal carbonized is about 3500 tons.

Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.

Tenders, endorsed "Tender for Tar," to be addressed to me, and to be delivered not later than Wednesday, the 25th of July.

WM. SANDEMAN,
Clerk.

Local Board Offices, Oswaldtwistle,
June 30, 1894.

LEIGH LOCAL BOARD.

THE Gas Committee of the Leigh Local Board invite TENDERS for the supply of GAS COAL or NUTS for a period of Eight Months, commencing on the 1st of November next.

The quantity required is 6000 tons.

Specification, with Tender Form and all Particulars, may be had from the undersigned.

Sealed tenders, endorsed "Coal," and addressed to the Chairman of the Gas Committee. to be delivered at the Town Hall, Leigh, not later than Monday, the 16th inst.

The lowest or any tender not necessarily accepted.

ALFRED T. FLETCHER,
Engineer and Manager.

Gas-Works, Leigh, Lancs.,
July 2, 1894.

LINCOLN CORPORATION.
(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the Lincoln Cor- poration invite TENDERS for the supply of 15,000 to 20,000 tons of screened GAS COAL and NUTS, to be delivered during a period commencing the 1st of September, 1894, and terminating the 30th of June, 1895.

Further Particulars and Forms of Tender may be obtained from the undersigned.

Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, must be delivered on or before the 27th inst.

The Committee do not bind themselves to accept the lowest or any tender.

JNO. CARTER,
Manager.

Gas Offices, Lincoln,
July 7, 1894.

WEST MALLING GAS COMPANY.

TENDERS FOR GAS COAL.

TENDERS are invited for the supply of about 550 tons (more or less) of PELTON MAIN or any other class of really good GAS COAL, to be delivered at the Company's Works, West Malling, between the 29th of September, 1894, and the 29th of September, 1895, in quantities of not more than 60 tons a month.

The name and quality of the Coal to be specified in the tender.

Sealed tenders, endorsed "Tenders for Coal," to be forwarded to me on or before the 16th of July next.

The Directors do not pledge themselves to accept the lowest or any tender.

By order,
HENRY D. WILDES,
Secretary.

West Malling, June 18, 1894.

JULY 17, 18, & 19.

Re GEORGE BOWER, VULCAN IRON-WORKS, ST. NEOTS.

TO ENGINEERS, GAS COMPANIES, GAS ENGINEERS, CONTRACTORS, AND OTHERS.

WHEATLEY, KIRK, PRICE, and GOULTY are instructed by the Trustee, Alfred Good, Esq., to SELL BY PUBLIC AUCTION, piecemeal in the lots of the Catalogue, upon the well-known Works, on Tuesday, Wednesday, and Thursday, the 17th, 18th, and 19th of JULY, commencing each day at Ten for Eleven o'clock prompt, THE ENTIRE CONTENTS of the several WORKS situate at St. Neots, Hunts., hitherto carried on by Mr. George Bower.

The Machinery, which is in first-class working order and by eminent Makers, includes numerous Hand, Sliding, Surfacing, Screw-Cutting, Boring, and Facing Lathes, from 6-inch to 24-inch centres, single, double, and treble geared, Radial, self-contained, and bench Drilling-Machines. Planing-Machines up to 4 feet square. Light and heavy Plate-Bending Machines, four Punching and Shearing Machines, Screwing, Shaping, Grinding, and other Machines. Cupolas, Cranes, about 150 tons Moulding Boxes, and Foundry Plant, Shafting, loose Plant and Utensils, Furniture, an immense assortment of Patterns and Drawings, and other effects.

The Stock includes New Horizontal Steam-Engines, Exhausters, Ammonia Liquor Pumps, thirteen new Gasholders from 50 ft. diameter by 15 ft. deep to 5 ft. diameter by 2½ ft. deep, 120 Gas-Valves, 350 Wet and Dry Meters, 3400 Glass Regenerative Bowls, 80 Pendants, several hundred Gas-Brackets, 50 Gaseliers (two to ten lights), Contents of Stores, several thousand Gun Metal Cocks, Valves and Fittings, new Steel, Bar Iron, Piping, Files, &c., &c.

Catalogues gratis upon application to ALFRED GOOD, Esq., 57, Moorgate Street, LONDON, E.C.; C. R. WADE GEARY, Esq., Solicitor, ST. NEOTS, or from the Auctioneers, WHEATLEY, KIRK, PRICE, AND GOULTY, 49, Queen Victoria Street, LONDON, E.C., and Albert Square, MANCHESTER. Telegrams: "Indices, London."

HAWORTH LOCAL BOARD OF HEALTH.

TENDERS invited for the purchase of the Board's surplus TAR and LIQUOR for the Year ending June 30, 1895, delivered on Rails at Haworth Station.

Tenders to be sent to me not later than July 12.

WM. ROBERTSHAW,
Clerk.

5, Temple Street, Keighley.

THE GASLIGHT AND COKE COMPANY.

TENDERS FOR COKE.

THE Directors of this Company are pre- pared to receive TENDERS for the purchase of COKE, to be supplied into Ships, Barges, or Railway Trucks at their Beckton, Nine Elms, Bromley, and Fulham Stations, within the Twelve Months ending the 30th of September, 1895.

Particulars and Forms of Tender can be obtained upon application at this Office.

Tenders to be sent in on or before Noon on Thursday, the 19th inst., addressed to me and endorsed "Tender for Coke."

The Directors do not bind themselves to accept the highest or any tender.

By order,
(Signed) JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., July 9, 1894.

HOLMSIDE GAS COALS.
(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16½ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum.

Full particulars on application to

MR. MARK ARCHER,
HOLMSIDE AND SOUTH MOOR OFFICES,
NEWCASTLE-ON-TYNE.

THE SILICA FIRE-BRICK COMPANY,

OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE

SILICA BLOCKS, BRICKS, AND CEMENT

OF SUPERIOR QUALITY
FOR GAS-FURNACES.

Trade Mark: "SILICA."

These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their

GREATER DURABILITY

Strongly recommended where EXCESSIVE HEATS have to be maintained.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF

FILES OF BEST QUALITY

FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES,
SPANNERS, RATCHET BRACES, LIFTING JACKS,
ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.

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90, CANNON STREET, E.C.

Just published.
With numerous Illustrations and Tables, crown 8vo. cloth, 6s.

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GAS ENGINEER'S LABORATORY HANDBOOK,

By JOHN HORNBY, F.I.C.
Honours Medallist in Gas Manufacture, City and Guilds of London Institute.

LONDON: E. & F. N. SPON, 125, Strand.
NEW YORK: 12, Cortlandt Street.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—		
Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, Ipswich Gaslight Company, Devonport Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,
LIMITED,
Newcastle-on-Tyne.
W. H. PARKINSON,
FITTER.

Lanemark Coal Co.,

LIMITED.

LANEMARK CANNEL AND GAS COALS.

Quotations and Analysis on application to

LANEMARK COLLIERY,

NEW CUMNOCK, N.B.

Shipping Ports: All the principal Scotch Ports.

SEE ADVT., p. 56 OF LAST WEEK'S JOURNAL; ALSO END PAGE OF NEXT ISSUE.

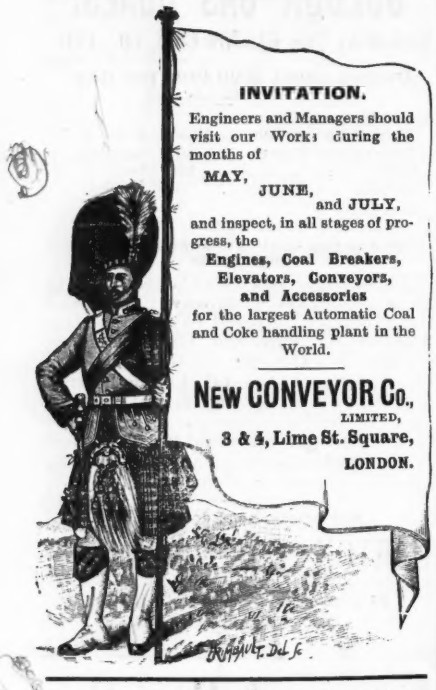
CLAPHAM BROS., Ld., Keighley, Yorks.

PRICE'S PATENT COKE & COAL BARROW

effecting a great saving of time, labour, and expense.

For particulars, price, &c., apply to Mr. E. PRICE, Inventor and Patentee, 22, Alwyne Road, Canonbury, LONDON, N.

Prices are Reduced.



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Engineers and Managers should visit our Works during the months of

MAY, JUNE, and JULY,

and inspect, in all stages of progress, the

Engines, Coal Breakers, Elevators, Conveyors, and Accessories

for the largest Automatic Coal and Coke handling plant in the World.

NEW CONVEYOR Co., LIMITED,
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Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887, for

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BOGHEAD CANNEL.

Yield of Gas per ton	13,155 cub. ft.
Illuminating Power	38·22 candles.
Coke per ton	1,301·88 lbs.

EAST PONTOP GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	70 per cent.

SOUTH PELAW MAIN GAS COAL.

Yield of Gas per ton	10,500 cub. ft.
Illuminating Power	16·3 candles.
Coke	73·1 per cent.

For Prices and complete Analysis, apply to

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ROBERT MARSHALL,
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97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

LOW MOOR BLACK BED GAS COAL.

YIELD OF GAS PER TON	10,375 CUBIC FEET.
ILLUMINATING POWER	17·50 SPERM CANDLES.
COKE	75 PER CENT.

Prices, f.o.r. or f.o.b., on application to

GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
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A TRIAL IS RESPECTFULLY SOLICITED.

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ALFRETON IRON-WORKS, DERBYSHIRE,
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Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.,

Manufacture and keep in Stock at their Works (also large stock in London)

PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.

NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with bolts, nuts and covers, and rendering leakage impossible.

CAST-IRON PIPES

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Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

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FOR PUMPING AIR, WATER, SEMI-FLUIDS, &c.

See Advertisement in last and next issue.

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CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL
ENGLISH & SCOTCH CANNELS.
REAL SILKSTONE GAS COAL
ANALYSIS AND PRICES ON APPLICATION.
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Gas Companies are solicited to try Samples of the

MIRFIELD BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

LONDONDERRY GAS COALS

FROM THE

MARQUIS OF LONDONDERRY'S COLLIERIES,

COUNTY OF DURHAM.

Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.

FOR PRICES AND PARTICULARS, APPLY TO

S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THORNLEY GAS COALS

WORKED BY THE

WEARDALE IRON AND COAL COMPANY, Ld.

OUT OF THEIR

THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]

TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,

For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.

Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.

The following is a complete ultimate Analysis of the Coal.

	PER CENT.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the

WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

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HUNTER'S
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JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF
NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

TROTTER, HAINES, & CORBETT,
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FIRE-CLAY & BRICK WORKS
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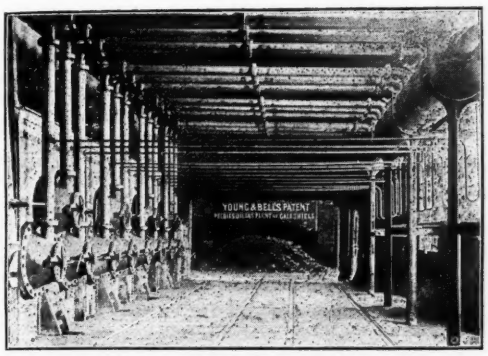
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

THE OIL-GAS ENRICHMENT COMPANY, LIMITED.
JOHN GORDON MASON, Solicitor, Secretary, 51, HANOVER STREET, EDINBURGH.



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A. F. CRAIG & CO., Engineers, **PAISLEY,**
AND
JOHN DENNIS, Contractor, **DALKEITH,**

Authorized Agents for Scotland, will be glad to **prepare Drawings and give Estimates** for supplying and erecting complete the necessary Plant for the Manufacture of Gas from Oils and Tars alone, or for the adaptation of the "PEEBLES" Oil-Gas Process to work in combination with the existing Coal Gas Plant, for all those disposed to introduce this Process.

They have been connected with the erection of more than three-fourths of the total plant started previous to 1894, including that of Peebles, Galashiels, Kelso, Musselburgh, Alloa, Innerleithen, Penicuik, Dalkeith, Lasswade, Alva, &c.

BENZOLE FOR ENRICHING GAS.

Specially prepared Benzole for fortifying Gas, **10d. (tenpence) per gallon** f.o.r. in Tank-Trucks, or in Casks One Penny per Gallon extra.

Costs only One-Third of a Penny per Candle.

One Gallon of Benzole is equal to Three Gallons of Petroleum Spirit for Carburetting Gas.

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GASEOUS FIRING
FOR LARGE OR SMALL
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PLANS, SPECIFICATIONS,
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FOR THE ERECTION OF GAS AND WATER WORKS
COMPLETE, AND FOR EXTENSIONS AND RENEWALS.

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GAS ENGINEERS & CONTRACTORS,
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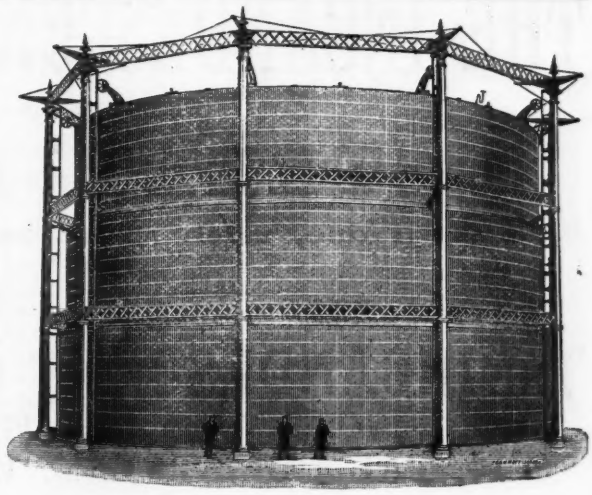
MAKERS OF
Gasholders and Gas Plant
OF EVERY DESCRIPTION.

Sole Agents for Scotland for the Automatic Coal-Gas Retort (Inclined System) Company, Limited.

Telegraphic Address: "Donald Paisley."



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BRASS GAS-FITTINGS GAS-VALVES, STEAM & WATER VALVES TOOLS, &c., AND OF
WARNER'S PATENT MARKET GAS STAND-PIPE.
LONDON: LAMBETH BRASS & IRON CO., Short Street, LAMBETH.

THE WIGAN COAL & IRON CO., LIMTD.,
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.
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TELEGRAPHIC ADDRESS: "PARKER LONDON."

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A SPECIALITY.

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WATER-WORKS PLANT
A SPECIALITY.
Apply for No. 8 Catalogue.

TO GAS COMPANIES, CORPORATIONS, AND VESTRIES.

IMPROVED STREET LIGHTING,
WITHOUT ADDITIONAL COST,
With THREE to FOUR TIMES the ORDINARY LIGHT,
CAN BE OBTAINED BY
THE INCANDESCENT GAS-LIGHT (Welsbach System),
WHICH HAS NOW BEEN ADAPTED TO
STREET LIGHTING,
And is in use, with great success, in many towns on the Continent.

Send for "Street Lighting" Pamphlet, which gives full particulars, to

THE INCANDESCENT GAS-LIGHT COMPANY,
LIMITED,
14, PALMER STREET, WESTMINSTER, LONDON.

Old Kentucky Shale, From Kentucky.

TRADE O. K. SHALE. MARK.

THE MOST VALUABLE GAS ENRICHER NOW AVAILABLE IN ANY DESIRED QUANTITY.

S. Calvert Ford, Government Inspector at Washington, reports it as giving—

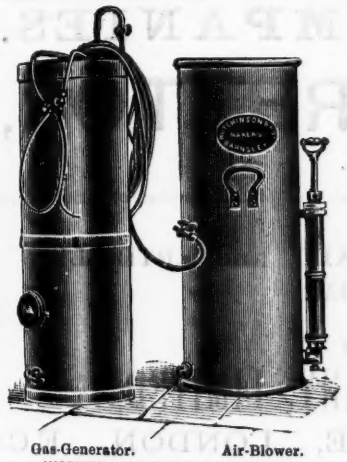
12,553 Cubic Feet of 50-Candle Gas, or 10,460 Cubic Feet of 60-Candle Gas,

AN EQUIVALENT OF 627,650 CANDLE-FEET.

Cargo Shipments to any PORT IN GREAT BRITAIN, on the CONTINENT, or SOUTH AMERICA.

PERKINS & CO., 228, PRODUCE EXCHANGE, NEW YORK.

Cable Address: "PERKINS, NEW YORK."



Gas-Generator. Air-Blower.

IMPROVED LEAD-BURNING APPARATUS.

HUTCHINSON BROS.,

GAS ENGINEERS, &c.

SPECIALITY.

LEAD WORK FOR SULPHATE OF AMMONIA PLANTS,

BEST QUALITY OF MATERIAL AND WORKMANSHIP.

SATURATORS, all Lead, or Strong Sheet Lead, in Wood Casing,

ACID TANKS, ELEVATORS, AND COCKS. LIQUOR AND LIME PUMPS OR INJECTORS.

Liquor-Cocks, Gauge Fittings, and Safety-Valves in Cast Iron.

HYDROMETERS, TEST-JARS (GLASS OR LEAD), COPPER SCOOPS, &c., &c.

IMPROVED LEAD-BURNING APPARATUS.

LEAD BURNERS SENT OUT TO REPAIRS.

FALCON WORKS, BARNSLEY.

Telegrams: "HUTCHINSON BROS., BARNSLEY."

ASHMORE, BENSON, PEASE, & CO., Limited,

Gas-Works Contractors, STOCKTON-ON-TEES.

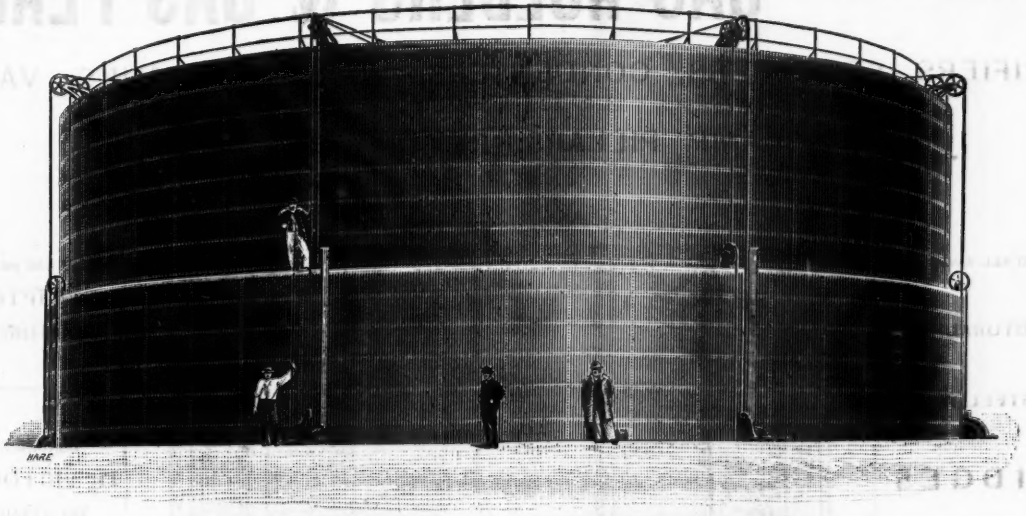


Illustration of BATHURST Holder, 82 feet diameter by 18 feet deep each Lift.

GASHOLDERS ON THE WIRE-ROPE SYSTEM

SUPPLIED TO THE FOLLOWING CORPORATIONS, COMPANIES, AND WORKS AT

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IMPORTANT TO GAS COMPANIES.

THE MAXIM CARBURETTOR,

FOR ENRICHING GAS IN BULK.

Used for the last Three Years by all the principal London Gas Companies, and since adopted by numerous Suburban and Provincial Companies and Corporations.

THE CARBURETTOR is INEXPENSIVE, EASILY FIXED, and ENTIRELY SUPERSEDES the use of CANNEL COAL.

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THE HORSELEY CO., LTD., TIPTON, STAFFORDSHIRE.

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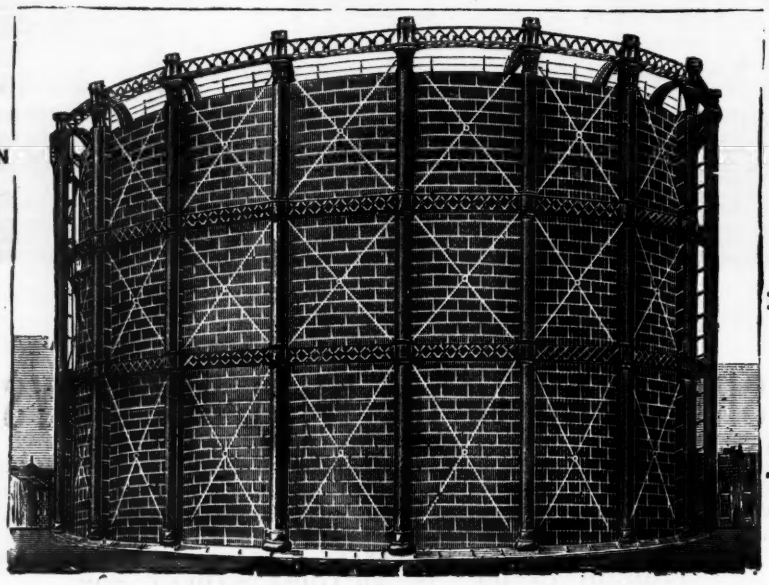

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The best **KENTUCKY CANNEL** in the Market.

Capacity of Mine, 160,000 Tons per Annum. Surface Drift Vein, 50 Inches Thick (*No Partings*).

AREA (ALL OWNED BY THIS COMPANY) 5000 TO 7000 ACRES (6000 TONS PER ACRE).

SAMPLE CARGO will demonstrate the extraordinary value of this Coal, and of the resultant Coke and other Bye-Products.

The unlimited quantity and REDUCED PRICE of this Material makes it the most satisfactory and economical Gas Enricher now available.

Result of Practical Working Test by Mr. John Methven, Engineer of The Gaslight and Coke Company, London, Aug. 8, 1893.

16·159 feet of 29·56 candles.
(484·770 candle-feet per 2240 lbs.)

Sperm Value	1638 lbs.
Specific Gravity	1200 (Water 1000)
Weight of 1 cubic foot	75 lbs.
Coke..	944 lbs.
Carbon in Coke	80·83 per cent.
Ash „ „	18·43 per cent.

Remarks by Mr. Methven—

"Sample received representing full section of working in mine. The whole sample was broken up and well mixed; and the practical results obtained represent the mean of 18 experiments. *The general results may be considered reliable.* The above results stamp this Cannel as being one of the most valuable obtainable. Not only does it possess a high yield of very rich gas, but its production of coke is of large quantity, and of a quality rarely found in cannels producing such a rich volume of gas. The coke is eminently suitable for mixing with coke from common coal; its percentage of ash being remarkably low."

Result of Laboratory Test by Mr. George R. Hislop, Gas Engineer, Paisley Scotland, Oct. 26, 1893.

14·630 feet of 41·24 candles.
(603·488 candle-feet per 2240 lbs.)

Sperm Value	2069 lbs.
Specific Gravity	1152 (Water 1000)
Weight of 1 cubic foot	72 lbs.
Coke..	994 lbs.
Carbon in Coke	92·30 per cent.
Ash „ „	7·70 per cent.

Remarks by Mr. Hislop—

"Very compact and cohesive, and uniform in composition and density. A cannel coal of exceptional value, and remarkable light-giving power and purity, affording a light and spongy coke of excellent quality. The Coal contains a very small percentage of both water and sulphur. Compared with Main Lesmahagow represented by 100, having regard to the value of the secondary products and cost of purification of the gas, this Coal is equal to 137·11."

COKE.—Briefly the "Bear Creek" Cannel produces a first-class Coke—that is, by itself, and unmixed with Coke from Common Coals—merchantable, comparing favourably with Coke from the Standard Gas Coals.

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NOTE.—The President of the above Company (Mr. F. A. Hull) is now in Europe; and Letters or Telegrams addressed to him care of Low's Exchange, 57, Charing Cross, London, until July 11, will receive prompt attention.

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Purifier-Houses erected at Huddersfield to designs by Mr. W. R. HERRING.

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Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

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NETHAM CHEMICAL CO., Limited, BRISTOL.
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THE DAVIS GAS-STOVE CO., LTD.,

SINGLE CASED CAST-IRON STOVES

(Specially designed and strongly constructed) for Gas Companies supplying Automatic Meters.

THE "CAM."

We can strongly recommend this Stove to the notice of intending purchasers, as it contains all our latest improvements in Single-Cased Stoves; and, considering the points of strength and general finish, it is decidedly a cheap Kitchener for the money.

It is similar in construction to the "LONDON" Series, but has a more extended Hot-Plate, which is detachable, and is fitted with three Ring-Burners and Grilling-Burner and Deflector, Pan, and Grid. The top plate beneath the Hot-Plate is enamelled white.

Required Space: 27½ in. high, 18 in. wide, 16½ in. deep. Inside dimensions of Roaster, 21 in. high, 11½ in. wide, 11½ in. deep.

PRICE £3 0s. 0d.

THE "STAR" Cast-Iron Cooker,

With Boiling-Burner, fitted with Grid-Bar, Meat-Hook, and Dripping-Pan.

DIMENSIONS.

	High. In.	Wide. In.	Deep In.
Hot-Plate	—	15	14½
Inside Roaster	17	11	11
Space required	22	17½	14½

PRICES: With 99*lb* Deflector-Pan and Grid . £1 13s. 6d.
Without . . . . . £1 10s. 0d.

If with Enamelled Crown Plate, 2s. extra.

THE "S.M."

This Stove has an oven large enough to take a 10-lb. joint, and is fitted with Dripping-Pan, two Grids and one Sheet-Iron Shelf, Cross-Bar and Meat-Hook. The Hot-Plate is fitted with two Boiling-Burners, Heat-Deflector, Pan and Grid, and will also grill chops, steaks, toast bread &c. At a practical test made by a Gas Company, 4lbs. of meat and two vegetables (3lbs. of potatoes and a good-sized cabbage) were thoroughly cooked at the cost of 1½d.; the Gas being passed both through a test and an Automatic Meter. Such a meal may be easily prepared and served in an hour and a half, burning only 26 cubic feet of Gas in an hour and a quarter—an economic consumption probably never obtained before. This marvellous little Cooker roasts, bakes, boils, grills, &c., to perfection.

DIMENSIONS.

	High. In.	Wide. In.	Deep. In.
Hot-Plate	—	14½	15½
Door Opening	17½	11	—
Inside Roaster	21	11½	11½

PRICES.

With 99*b* Deflector, Pan and Grid . £1 18 6
Without £1 15 0

The Oven is fitted with two Burners, so arranged that they can be readily taken out for cleaning, and replaced without disconnecting the Stove.

If with White Enamelled Crown Plate, 2s. 6d. extra.

THE "SUN."

Cast-Iron Cooker, with two *loose* Cast Boiling-Burners, and fitted with two Grid-Shelves, one Sheet-Iron Shelf, Dripping-Tin, Cross-Bar, and Meat-Hook. It is of the same design as the "S.M." shown above; but the dimensions are different.

DIMENSIONS.

	High. In.	Wide. In.	Deep. In.
Hot-Plate	—	18	16
Door Opening	17	12	—
Inside Roaster	23	12	12

PRICE, £2 7s. 6d.

If with White Enamelled Crown Plate, 2s. 6d. extra.

This Stove has no Deflector, Pan, or Grid.

THE "LONDON." (Reduced Prices)

No.	Inside Dimensions of Roaster. Wide.	Deep.	High.	No. of Burners on Top.	Prices. £ s.
40*a*	11½ in.	11½ in.	18 in.	1	1 10
40	11½ ,,	11½ ,,	18 ,,	2	1 15
41*a*	11½ ,,	11½ ,,	21 ,,	1	2 0
41	11½ ,,	11½ ,,	21 ,,	2	2 5
42*a*	12 ,,	12 ,,	23½ ,,	1	2 10
42	12 ,,	12 ,,	23½ ,,	2	2 15
43	12 ,,	13 ,,	24 ,,	2	3 3
44	14 ,,	15 ,,	26½ ,,	3	3 15

* The Nos. 40*a* and 40 are not provided with the Toasting Apparatus.

These Stoves have a single Cast-Iron Body, with Double-Cased Cast-Iron Top to Roaster, filled in with non-conductor, are fitted with Drip-Pan, Grid-Iron, Cross-Bar, Meat-Hook, &c., and are guaranteed to Roast and Bake perfectly. The Hot-Plate is fitted with an extra Pan and Grid-Iron, and our Patent Steel Heat-Deflector, which toasts bread and grills meat or fish more quickly and much better than a coal fire.

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ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.
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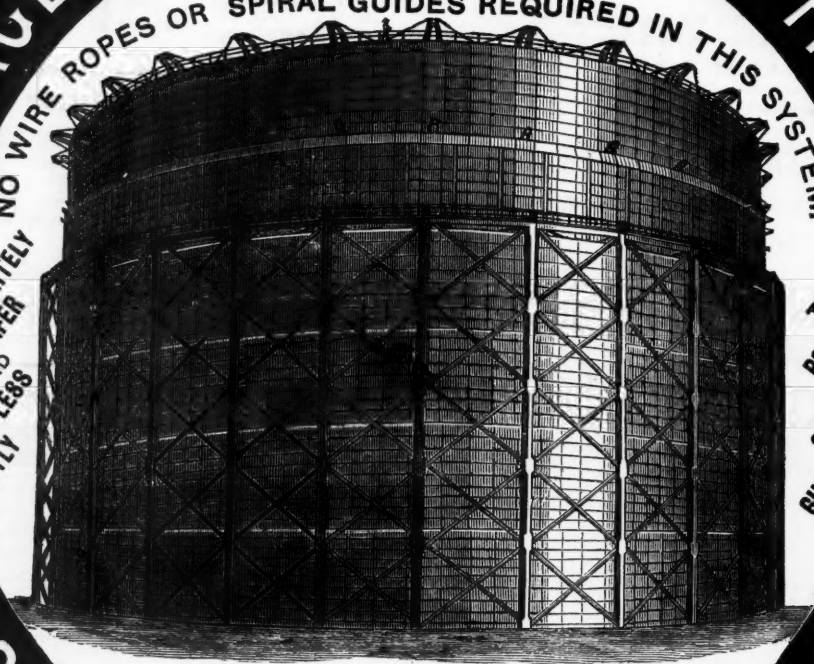
NO WIRE ROPES OR SPIRAL GUIDES REQUIRED IN THIS SYSTEM.



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BEST QUALITY.
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[See Illustrated Advertisement, July 3, p. 50.]

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Contractors for the Erection of Gas-Works Complete, RETORT-SETTINGS, Furnace Building, the Erection of Retort-Benches, &c., &c.
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See Illustrated Advertisement, p. II. Centre of JOURNAL for July 3.

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A 280-CANDLE POWER
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less than half the price of any other Regenerative Lamp.
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VOLCANIC FIRE CEMENT
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In Use in more than 200 British Gas-Works.

Heat Resistance, 4500° Fahr.
Directions for Use, and all Particulars, sent post free.
PACKED IN CWT. BAGS.
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Having purchased the old-established Lamp and Meter Business of

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[See also Advt., p. 66.

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